



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

EIGHTH ANNUAL REPORT
OF THE SUGARCANE
RESEARCH STATION,
FOR THE YEAR
1937.

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Eighth Annual Report of the Sugarcane Research Station for the Year 1937

INTRODUCTION

BY OFFICER IN CHARGE

Mr. A. G. G. Hill, Senior Geneticist, officer in charge of the Station, who has been promoted to be the Director of the Amani Institute, Tanganyika, left the Colony on leave of absence prior to transfer on February 6, 1937. Much of the success which has already resulted from the efforts of the Sugarcane Research Station must be attributed to his administration, and I feel that in his departure the Colony has suffered a real loss.

The staff of the Sugarcane Research Station was considerably below strength for the whole of the period under review. Mr. N. Craig, Bio-Chemist, returned from foreign leave of absence on February 17, 1937, when this officer was appointed Acting Geneticist in charge of the Station. Dr. Evans, Physiological Botanist, was in charge of the Station from February 6 to February 17, 1937. Mr. G. Mazery returned from leave of absence on March 10, 1937, when he took charge of the work at Pamplemousses Experimental Station. Prior to this date, Mr. P. Tennant, a temporary assistant, had been in charge. On account of increased work with pineapples and other crops, the services of the Agronomist were not available to the same extent as in previous years, and on the departure of the Director of Agriculture on leave, the Agronomist was appointed as Acting Senior Agricultural Officer, after which his services were not available at all.

Considerable delay and difficulty was at times caused in the reaping of trials on estates on account of the labour unrest in the Island, but it is gratifying to be able to record that in spite of these difficulties and in spite of the extremely heavy crops which had to be handled by estates, the harvesting programme was satisfactorily carried out.

Four meetings of the Research Advisory Committee were held in April and May, and as a result of frank discussions the Sugar Industry Reserve Fund was approached to provide funds for the employment of two additional field assistants for the extension of field experimentation, particularly with respect to cultivation practices. Up to the present only one has been appointed, no other suitable candidate being available at the beginning of the financial year 1936-37. Mr. P. Tennant, an ex-student of the Mauritius Agricultural College, was selected for one of these posts, and has already got four experiments on estates and four demonstration plots on small planters' lands under way. It is expected that several more experiments will be started in the near future. Another meeting of the Research Advisory Committee was held in December to discuss the progress made with the various projects.

It has been decided that in future the constitution of the Research Advisory Committee will be slightly altered, the number of unofficial members being increased by one to six, two of whom will be appointed by the Committee of the Sugar Industry Reserve Fund, two by the Board of the Agricultural College and two by Government. The Mauritius College of Agriculture and the Sugar Industry Reserve Fund of the Chamber of Agriculture contributed Rs. 18,000 and Rs. 10,000 respectively, towards the cost of the Station, and in addition the latter body provided Rs. 4,000 for extra field assistants.

The provision of fresh accommodation for the offices and laboratories of the Station is under consideration, on account of overcrowding in the present laboratories and lecture rooms of the Agricultural College, due to more numerous entries than in the past. Rough plans have been drawn up, and these are at present in the hands of the Public Works Department.

The progress made with the Research programme of the three divisions of the Station has been satisfactory, but the scope of work in the Chemical Division had to be reduced somewhat because the Scientific Assistant was the only officer engaged upon this branch of the work continuously. Detailed reports of the work performed by each division are given below.

PART I—CANE-BREEDING

BY N. CRAIG

General

It is gratifying to record that the interest shown by the planting community in the newly released clones, i.e. M.171/30, M.72/31 and M.73/31 would appear to be increasing, judging from the demands for them received by the Agricultural Division. This Station has supplied many thousand cane cuttings for distribution to planters and it seems likely that in the near future there will be a considerable increase in the area under these varieties. At one period, it was being stated that M. 171/30 was badly diseased on one estate, but an enquiry conducted with the help of the Acting Plant Pathologist on this estate and several others in various parts of the Island showed that it was perfectly healthy, and a note to this effect was published in the Press and in the *Revue Agricole*. Since this time, it is to the writer's knowledge that this variety is being propagated as quickly as possible on several estates, several of which have some five to ten acres under it. M.73/31 has not achieved the same popularity, probably because of (1) its habit of growth, (2) its apparent susceptibility to attacks of borers and to some extent to red rot. In some trials, however, it has given satisfactory results, and in view of its manner of growth it has been sent to three estates to be planted in areas heavily infested with *Phytophthora smithi* (Arrow). M.72/31 has on the whole given very satisfactory results, and in some trials has beaten M.171/30. It has a very good habit of growth, has a very healthy appearance, does not appear to be susceptible to borer attack, and has a sucrose content about equal to that of BH. 10(12), and better than M.171/30. Unfortunately the clone M.108/30 which was released for general distribution, on the ground of *Phytophthora* resistance, has not been very satisfactory this year in so far as sucrose content and purity of juice is concerned. Two crushing tests performed at La Baraque gave unsatisfactory results, so that it is suggested that this cane should only be propagated very slowly and that before it is planted on a large scale properly controlled crushing tests be made to determine its factory value.

A further variety, M.184/32, a seedling bred in 1932 from POJ.2878 x D. 109, has been released for general distribution, and has now been distributed to most estates. This cane variety has a good habit of growth, appears very healthy and has a high sucrose content. On the other hand, it arrows slightly and in one trial at least it suffered from damage by rats, whereas the other varieties in the trial were unaffected.

Other clones which have given satisfactory results in 3rd or 4th trials are now being tested in larger scale trials, the first results of which will be known during the crop season of 1938.

More detailed information respecting these varieties will be given later in this report.

Climatic conditions—Excellent conditions for growth obtained during 1937, with the result that the sugar crop has exceeded the previous record crop of 1936 by about thirteen thousand tons of sugar. The growth index figure calculated by the Statistician of the Department of Agriculture for the 1937 crop was 7.12 against an average figure for the past fourteen years of 5.9. For this reason, therefore, the yields in many trials, both varietal and manurial, have been high. There was an absence of destructive cyclones during the year, and the growing season was characterised by well distributed rains throughout the main growing season of January to May. The latter part of the year was moderately dry, although the rainfall was generally in excess of the average, and in November one or two good showers were obtained, but December was again very dry. The figures for the Central Experiment Station and for the Pamplemousses Experimental Station are given in the following table, together with the excess or deficiency compared with the average. The departure from the average temperature is also given for the former station.

	Central Experiment Station			Pamplemousses Experiment Station	
	Rainfall in inches	Excess (+) or deficiency (—) % average rainfall	Temperature above (+) or below (—)	Rainfall in inches	Excess (+) or deficiency (—) % average rainfall
January	... 12.69	+ 24	— 0.1°C	15.09	+ 55
February	... 8.72	— 20	+ 0.6	6.85	— 21
March	... 16.47	+ 39	+ 0.5	15.97	+ 73
April	... 2.48	— 54	+ 0.1	3.85	— 35
May	... 8.05	+ 92	+ 0.6	14.47	+ 226
June	... 2.69	— 15	+ 0.0	1.93	— 43
July	... 2.11	— 22	+ 0.7	4.85	+ 67
August	... 3.13	+ 20	+ 0.0	4.25	+ 40
September	... 2.68	+ 59	+ 0.7	2.94	+ 62
October	... 1.96	+ 4	— 0.4	2.02	+ 4
November	... 3.04	+ 24	+ 0.4	5.49	+ 62
December	... 1.71	— 73	— 0.2	1.52	— 69

Crossing Programme 1937.—In general, this was based upon the same considerations as in the previous year, but in addition to the combinations which had already been proved to produce seedlings of a high standard many other combinations were tried. In particular, two seedlings produced by this Station were used for the first time in trial marriages, viz M.134/32, a seedling of great promise from the combination POJ. 2878 × D.109, and M.188/33, a seedling of POJ.2878 × BH. 10 (12), which has many desirable properties, but which unfortunately arrows too profusely to be of much value for economical planting. The work was carried out at both the Central Experiment Station at Réduit and at Pamplemousses Experiment Station. Climatic conditions were favourable during the crossing season, and a large number of seedlings was raised at both Stations, this being the eighth successful season in succession.

At the Central Experiment Station 176 crosses were made, including 7 done for the Sugar Experiment Station at Mt. Edgecombe, in the Union of South Africa, and 4 which were sent to the Director of Plant Breeding, New

South Wales. The total number of seedlings raised at this Station in boxes exceeded 47,000 of which 41,000 were bred by the open method, 5,500 by the bag method and nearly 1,000 by the lantern method.

At the Pamplémousses Experiment Station, the total number of crosses carried out was 150, from which about 33,000 seedlings were obtained, 16,500 by the open method, 10,700 by the bag method and 6,300 by the lantern method.

In view of the fact that some combinations could be made at one station and not at the other, there was a certain interchange of seedlings in boxes from one station to the other, in order to test the seedlings over as wide a range of conditions as possible. A large number of seedlings were potted out at each station, 16,447 at C.E.S. and 17,700 at P.E.S., and planting out in the field was started at the beginning of December. This planting has been somewhat retarded by the extremely dry conditions prevailing during December, which has rendered necessary frequent waterings of the newly planted seedlings. As a consequence, the full number of seedlings was only planted out by the middle of January 1938 the totals being nearly 12,000 at C.E.S. and about 10,000 at P.E.S.

1st Year Trials with seedlings raised in 1936.—These seedlings are rather backward in their growth and up to the present no selections have been made, but it is intended to begin making selections from this population early in January. The growth in one field at the Central Experiment Station has been extremely variable, and it would appear that some obscure root trouble is the cause of this. The result is that extremely profuse tillering takes place, but all the tillers are extremely stunted in growth, and in extreme cases death results, whilst an examination of the roots shows a very compact mass of fibrous roots of short length, and no fresh white roots at all. This matter is at present under investigation by the Acting Plant Pathologist of the Department of Agriculture. Furthermore, it is interesting to note that seedlings of the combination 131. P(♀) x P.O.J.2878 (♂) which were planted out at both stations, made extremely poor growth in each locality.

2nd Trial Seedlings.—On account of the new policy of placing selected clones from the 1st year trials into propagation plots before being included in the 2nd-trials, only few of the latter were reaped during the year, none at the Central Experiment Station and seven only at the Pamplémousses Experiment Station containing 68 clones of the 1934 series from which ten or 15% were selected for further trial. Three others have been retained for further observation.

During the course of the year, 29 second trials, comprising 233 clones selected from the 1935 seedlings, were laid down from the propagation plots. These propagation plots are helpful in that the clones may be arranged in order of vigour, those with too poor growth being eliminated, and again they were all examined for gumming disease before being included in these trials. Quite a large number of the clones in the propagation plot at the Central Experiment Station at Réduit showed too high a degree of susceptibility to this disease, but at Pamplémousses all were healthy.

3rd-Trial Seedlings.—In all twelve 3rd-trials were reaped during the crop season, seven of these being in first ratoons and the remainder in virgin canes. In all 53 clones were included in these trials, and from these 11 have been chosen for further trial, eight already having been included in 4th or Field trials, whilst the other three will be included when planting material is available in May-June, 1938.

4th or Field Trials.—Many of these trials reaped during the crop season of 1937 in virgin canes are of very great interest, in that for the first time the clones released for general distribution by the Sugarcane Research Station have been tested in widely different conditions. At the Central Experiment Station and Pamplemousses Experiment Station ten of these trials have been reaped, eight in virgin canes and two in ratoon canes.

Co-operative experiments reaped on sugar estates number seventeen, six of these being with virgin canes and eleven with ratoon canes. The tabulated results of all these field trials are given later on page 20.

More field trials containing the best of the "M" seedlings have been started during the course of the year, four upon estates and five at the Experiment Stations. In the former, only released varieties are being tried with one exception, i.e. M. 140/31, a fourth nobilised glagah type, which has shown up very well in some trials, but about which there is some doubt as to its power of resistance to gumming disease. Consequently it is undergoing further trial in this respect by the division of Plant Pathology, and it is at the same time being tested on an extended scale with respect to its yield properties by this Station.

In view of the very keen interest shown in the newly released varieties, tables have been prepared showing the performance of each of these varieties reaped up to date and from this table it will be seen that they have in general given very satisfactory results, especially M.171/30, M.72/31 and M. 134/32.

Phytalus Resistant Varieties.—The variety M.108/30, which has been released for general distribution since 1935, has not in general given very good results during the 1937 crop season. In general its sucrose content has been much lower than in the previous year and the purity of its juice somewhat low. The sucrose content of all canes has been lower in 1937 than in 1936, but the drop in M.108/30 seems to have been much greater than the average. In consequence it is recommended that this variety should be propagated slowly, and that before any large area is planted with it, it should be thoroughly tested in the factory, by means of properly conducted crushing tests. The two varieties M.167/32 and M.168/32 have been reaped in a trial situated at Trianon S.E. in an area free from *Phytalus Smithi*, and they gave exceptionally good yields in the field, namely 91.4 and 80.4 tons per arpent, respectively, compared with 50.2 tons per arpent with POJ. 2878, but again the sucrose content was on the low side, viz 12.6% and 11.9%, respectively, compared with 13.9% in POJ. 2878. These varieties are practically non-arrowing up to the present. At Britannia S.E., where these two varieties were selected, a commercial planting of M.168/32 in a *Phytalus* infested area, is showing up remarkably well in virgin canes, and is due to be reaped during the 1938 crop season. Other canes of similar parentage are planted in the same locality, but none appears to be equal in vegetative vigour to M.168/32. It is hoped to get some crushing tests done with these varieties during the next crop season, to determine its value from a factory point of view.

The search for other varieties of higher quality able to withstand heavy infestations of this major cane pest in Mauritius is being continued, and the Botanist has laid down a fairly large trial at Côte d'Or S.E. in this connection. M.72/31, a variety which suggests by its habit of growth that it may withstand fairly heavy attacks, has been planted on plots of about 0.5 arpent on three estates in heavily infested areas.

Small Planters Canes.—A certain amount of trouble was caused during the past crop season because of the production of canes of very low quality,

notably some of the Uba de Rich Fund varieties. These varieties are chiefly grown in the neighbourhood of Lallmatie and Bon Accueil and the total area was very roughly surveyed and the soils examined. The description of these soils will be given in the chemical section of this report. It must be remarked here, however, that up to the present no variety tests have been carried out on this type of soil, so that it was impossible to give any definite information as to the varieties which could be used to replace the inferior cane varieties at present cultivated. Three small plots were started in October in conjunction with Co-Operative Credit Societies in this neighbourhood, with the object of finding a variety which can be recommended for planting with a certain degree of confidence. Each plot contains three varieties replicated four times. The varieties under test are as follows :—

St. Julien d'Hotman ...	POJ.2727	M. 27/16	M. 13/18
Lallmatie ...	POJ.2727	M. 27/16	M.108/30
Bon Accueil ...	POJ.2727	M.108/30	M.140/31

At St. Julien, germination has been rather slow, and uneven, and a fairly high mortality has been caused by the attacks of cane borers. At the others, however, germination was extremely good and quick, and the canes are all making very satisfactory growth, and it is gratifying to record that the members of these societies are taking great interest in these plots, and should one or more of these varieties prove suitable to the locality, I confidently expect that it will be propagated as quickly as possible.

Another small plot containing POJ.2727, M.27/16, M.13/18 and M.108/30, together with a few stools of M.14/26, M.171/30 and M.73/31 was started in November at Solférino, another area in which a certain proportion of Uba de Rich Fund canes are cultivated. The canes germinated fairly well in this plot, but later they were suffering from drought.

Efforts are being made to start other small plots in neighbourhoods where there are many small planters, in conjunction with the Co-Operative Credit Societies.

Method of Planting.—Many of the 3rd trials planted at Pamplémousses Experiment Station were planted with ashes in the holes, instead of pen-manure, and germination of the cuttings was very slow but the final percentage germination was very good. It was thought that this slow germination might have been caused because of the ashes applied at planting, and consequently in one propagation plot, part of each variety was planted with pen manure in the normal way, and part with ashes as in the 2nd trials. Regular germination counts were made, from which it was seen that quicker and better germination was obtained with the ashes than with the pen manure. The slow germination of the cuttings in the 2nd-trials was therefore probably due to other causes, one of which may have been that the cuttings were made from very tender canes.

The various lists of crosses, tables showing the performance of cane varieties released for general distribution, and the results of field trials are given on the following pages.

Close co-operation with the various divisions of the Department of Agriculture has been maintained particularly with those of Agriculture, Entomology, Plant Pathology, Sugar Technology and Statistics, and I desire to express my appreciation of the help received from the officers in these divisions in some investigations outside the scope of this Station.

Rédut,
January, 1938.

N. CRAIG,
Sugarcane Research Station.

APPENDIX I

LIST OF CROSSES MADE DURING 1937 AT C.E.S. & P.E.S.

I. CROSSES BETWEEN "NOBLE" CANES

COMBINATION			Location of cross	No. of crosses made	No. of seedlings obtained	No. of seedlings planted	
						C.E.S.	P.E.S.
BH, 10 (12)	×	DK. 74	Reunion	1	0	0	...
"	×	M. 27/16	"	2	1	0	...
"	×	M. 109/26	"	1	0	0	...
"	×	M. 171/30	"	1	0	0	...
Big Tanna	}	×	M. 27/16	1	0	0	...
Mon Desert			Mon Reve				
Black Tanna	×		C.E.S.	1	1	0	..
"	×	SC. 12/4	"	1	15	13	...
Louzier	×	M. 27/16	"	1	18	0	...
"	×	SC. 12/4	"	1	300	23	...
H. 109	×	M. 27/16	P.E.S.	1	675	...	204
M. 33/19	×	D. 109, str.	"	1	270	...	0
"	×	M. 27/16	"	1	240	...	0
M. 26/20	×	M. 24/25	"	1	400	...	144
M. 109/26	×	M. 27/16	"	1	2,000	...	0
"	×	SC. 12/4	C.E.S.	1	50	30	...
M. 171/30	×	"	"	1	205	180	...
R. P. 6	×	M. 23/16	Mon Reve	4	95	50	...
"	×	M. 27/16	M/Reve. & C.E.S.	5	2,900	1,190	304
"	×	M. 35/17	Mon Reve	1	235	54	...
"	×	M. 171/30	"	1	0	0	...
"	×	SC. 12/4	"	2	1,300	192	274
"	×	55. P	"	1	40	30	...
White Tanna	×	M. 27/16	C.E.S.	2	0	0	...
55. P	×	SC. 12/4	Mon Reve	2	1,500	270	...
Total ...				35	10,245	2,032	926

II. INTERSPECIFIC CROSSES

1. 2nd Nobilised Glagah :—

Kassoer	×	D. 109	P.E.S.	1	25	...	0
"	×	D. 109, white	"	1	10	...	0
"	×	M. 27/16	"	1	35	...	0
"	×	Senneville	"	1	25	...	0
Total ...				4	95	...	0

2. 3rd Nobilised Glagah :—

M. 26/20	×	MX, 9/32	P.E.S.	1	0	...	...
MX. 6/32	×	D. 109, white	"	1	30	...	0
POJ. 2364	×	D. 109, str.	"	1	45	...	0
"	×	D. 109, white	C.E.S.	1	160	135	...
"	×	M. 23/16	P.E.S.	1	1	...	0
"	×	M. 27/16	"	1	295	...	180
"	×	M. 50/19	"	1	175	...	84
"	×	M. 37/26	C.E.S.	2	260	209	...
"	×	M. 109/26	"	3	40	0	...
"	×	"	P.E.S.	1	140	...	120
"	×	87. P	C.E.S.	1	1,000	175	...
Total ...				14	2,146	519	384

II, INTERSPECIFIC CROSSES—(Continued)

Combination			Location of cross	No. of crosses made	No. of seedlings obtained	No. of seedlings planted	
						C.E.S.	P.E.S.
3. 4th Nobilised Glagah :—							
BH. 10 (12)	×	POJ. 2878	Reunion	3	2	0	...
Louzier	×	"	C.E.S.	1	5	0	...
M. 20/16	×	"	"	1	45	30	...
M. 17/18	×	"	P.E.S.	2	805	...	...
M. 33/19	×	"	C.E.S.	4	1,290	514	...
"	×	"	P.E.S.	1	375	...	...
M. 26/20	×	"	"	3	15	...	...
M. 11/29	×	"	"	1	40	...	...
M. 13/30	×	"	C.E.S.	2	145	102	...
55. P	×	"	Mon Reve	3	155	87	...
55. P	×	"	P.E.S.	2	350	...	...
131. P	×	"	"	1	280	...	...
POJ. 2727	×	DK. 74	"	1	14	...	...
"	×	D. 109	C.E.S.	3	4	0	...
"	×	D. 109, str.	P.E.S.	4	68	...	51
"	×	D. 109, white	"	3	35	...	...
"	×	D. 109, white	C.E.S.	4	31	0	...
"	×	M. 23/16	P.E.S.	2	25	...	...
"	×	M. 27/16	"	2	6	...	...
"	×	M. 35/17	"	2	35	...	...
"	×	M. 24/25	"	2	37	...	...
"	×	M. 37/26	C.E.S.	2	10	0	...
"	×	M. 37/26	P.E.S.	3	107	...	74
"	×	M. 109/26	"	2	115	...	89
"	×	M. 48/30	C.E.S.	2	20	0	...
"	×	87. P	"	2	375	207	...
"	×	87. P	P.E.S.	1	400	...	123
"	×	Senneville	"	1	23	...	14
POJ. 2878	×	D. 109	C.E.S.	3	65	48	...
"	×	D. 109	P.E.S.	9	1,038	...	543
"	×	D. 109, str.	"	5	578	...	414
"	×	D. 109, white	C.E.S.	8	220	182	...
"	×	D. 109, "	P.E.S.	6	765	...	558
"	×	M. 23/16	"	1	80	...	57
"	×	M. 27/16	"	1	35	...	...
"	×	M. 35/17	C.E.S.	4	605	481	...
"	×	M. 35/17	P.E.S.	4	330	...	247
"	×	M. 24/25	"	2	255	...	197
"	×	M. 37/26	C.E.S.	2	200	171	...
"	×	M. 37/26	P.E.S.	1	55	...	42
"	×	M. 109/26	C.E.S.	10	715	607	...
"	×	M. 109/26	P.E.S.	4	313	...	228
"	×	M. 48/30	C.E.S.	2	175	70	...
"	×	SC. 12/4	"	1	45	30	...
"	×	87. P	"	3	4,000	174	...
E P. 6	×	POJ. 2878	Mon Reve	1	30	27	...
Total				127	14,316	2,730	2,637
4. 5th Nobilised Glagah :—							
Big Tanna	}	×	M. 72/31	M. Reve	1	0	...
Mon Desert							
M. 20/16	×	M. 72/31	C.E.S.	1	50	0	...
M. 1/17	×	M. 72/31	"	2	200	140	...
M. 33/19	×	POJ. 2940	P.E.S.	1	15	...	0
M. 26/20	×	POJ. 2940	"	1	1,000	...	190
Black Tanna	×	M. 72/31	C.E.S.	1	1	0	...
M. 13/30	×	M. 72/31	C.E.S.	1	400	156	...
M. 73/31	×	M. 37/26	C.E.	1	590	209	...
M. 134/32	×	D. 109	P.E.S.	1	300	...	0
Carried over				10	2,556	505	190

II. INTERSPECIFIC CROSSES - (Continued)

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings planted C.E.S. P.E.S.	
4. 5th Nobilised Glagah (Contd.) :—						
	Brought forward	...	10	2,556	505	190
M. 134/32	× D. 109, str.	P.E.S.	1	135	...	0
"	× D. 109, white	C.E.S.	1	40	30	...
"	× D. 109, white	P.E.S.	1	250	...	0
"	× Louzier	P.E.S.	1	8	...	0
"	× M. 23/16	C.E.S.	2	225	164	...
"	× M. 23/16	P.E.S.	2	20	...	...
"	× M. 27/16	C.E.S.	3	505	222	...
"	× M. 27/16	P.E.S.	2	1,308	...	225
"	× M. 35/17	C.E.S.	1	100	66	...
"	× M. 35/17	P.E.S.	1	255	...	...
"	× M. 24/25	P.E.S.	1	335	...	...
"	× M. 109/26	C.E.S.	3	115	77	...
"	× M. 109/26	P.E.S.	1	250	...	...
"	× SC. 12/4	C.E.S.	4	95	69	...
"	× 55. P	do	1	15	0	...
"	× 87. P	P.E.S.	1	90	...	...
M. 188/33	× D. 109	do	1	2	...	...
"	× D. 109, str.	do	1	360	71	132
"	× D. 109, white	do	1	760	353	277
"	× M. 23/16	do	1	612	180	238
"	× M. 27/16	do	1	95	...	48
"	× M. 35/17	do	2	1,040	...	471
"	× M. 24/25	do	1	320	...	72
"	× M. 109/26	do	1	330	78	195
"	× Senneville	do	2	170	...	121
R. P. 6	× M. 72/31	Mon Réve	1	400	130	...
131. P.	× POJ. 2940	P.E.S.	1	120	...	...
Total ...			49	10,511	1,945	1,969
5. Other Combinations :—						
Kassoer	× Selangor Seedling	P.E.S.	1	375	...	...
M. 20/16	× Lalri selfed seedling	C.E.S.	1	300	25	...
"	× Selangor Seedling	do	1	385	285	...
Lalri selfed seedg.	× M. 27/16	do	2	6	0	...
M. 23/16	× Selangor Seedling	P.E.S.	2	230	...	133
M. 17/18	× M. 196/31	do	1	150	...	...
M. 17/18	× Uba Marot	do	1	125	...	...
M. 33/19	+ M. 140/32	do	1	750	...	...
M. 33/19	× Seedg. No. 10814/348*	C.E.S.	2	125	99	...
M. 33/19	× Selangor Seedling	do	1	350	281	...
M. 33/19	× "	P.E.S.	1	55	...	...
M. 26/20	× M. 196/31	do	1	25	...	...
M. 26/20	× Selangor Seedling	do	1	135	...	110
M. 26/20	× Uba Marot	do	1	0	...	...
M. 109/26	× M. 108/30	C.E.S.	1	...	...	...
M. 109/26	× M. 196/31	do	2	...	...	...
M. 109/26	× Selangor Seedling	P.E.S.	1	700	...	208
M. 109/26	× Uba Marot	do	1	800	...	0
M. 11/29	× Selangor Seedling	do	1	680	30	364
M. 13/30	× "	C.E.S.	1	40	30	...
M. 108/30	× M. 27/16	P.E.S.	1	2	...	0
M. 73/31	× POJ. 2940	C.E.S.	1	20	0	...
M. 108/32	× DK. 74	do	1	1	0	...
M. 134/32	× M. 72/31	do	1	2,000	167	...
M. 134/32	× POJ. 2878	do	2	400	0	...
M. 134/32	× "	P.E.S.	1	700	...	275
M. 134/32	× POJ. 2940	do	1	530	...	...
Carried over ...			32	8,884	917	1,090

* New Style Kassoer.

II. INTERSPECIFIC CROSSES—(Continued)

COMBINATION	Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings planted	
				C.E.S.	P.E.S.
5. Other Combinations. —(Continued.)					
Brought forward		32	8,884	917	1,090
M. 134/32	× Selangor Seedling	C.E.S.	1	1,500	0
M. 134/32	× "	P.E.S.	2	2,680	228
M. 188/33	× M. 108/30	do	2	32	24
M. 188/33	× POJ. 2940	do	1	700	255
M. 188/33	× Selangor Seedling	do	1	600	204
M. 193/33	× M. 108/30	do	1	85	0
M. 193/33	× Selangor Seedling	do	1	125	75
POJ. 2727	× M. 72/31	C.E.S.	2	125	108
POJ. 2878	× M. 60/31	do	1	1,000	132
POJ. 2878	× Uba Marot	do	4	7,000	167
POJ. 2878	× "	P.E.S.	2	2,900	272
R. P. 6	× M. 108/30	Mon Réve	1	40	24
R. P. 6	× Selangor Seedling	do	2	10	0
Selangor Seedling	× D. 109	C.E.S.	3	340	278
"	× M. 23/16	P.E.S.	1	75	36
"	× M. 27/16	C.E.S.	3	1,100	347
"	× M. 35/17	P.E.S.	1	35	0
"	× M. 109/26	C.E.S.	2	225	201
"	× M. 109/26	P.E.S.	1	800	286
"	× M. 108/30	C.E.S.	3	3,000	244
"	× M. 68/31	do	1	3,000	215
"	× M. 72/31	do	1	2,000	180
"	× M. 196/31	do	4	1,200	279
"	× M. 108/32	do	1	500	180
"	× M. 99/34	do	2	80	70
"	× SC. 12/4	do	2	1,100	232
"	× Uba Marot	do	1	400	180
"	× Uba Marot	P.E.S.	2	470	301
55. P	× M. 108/30	Mon Réve	1	6	0
55. P	× M. 108/30	P.E.S.	1	4	0
55. P	× Selangor Seedling	do	1	400	0
131. P	× M. 108/30	C.E.S.	1	2,000	244
131. P	× M. 196/31	do	1	...	...
131. P	× Selangor Seedling	do	2	620	470
131. P	× Uba Marot	P.E.S.	1	385	0
55/74	× Selangor Seedling	do	1	600	0
Total ...		90	44,021	4,666	3,300

III. INTERGENERIC CROSSES

*MZ 5/33	× D. 109	P.E.S.	1	0	...	...
*MZ 5/33	× D. 109 str.	do	1	0	...	...
*MZ 5/33	× POJ. 2940	do	1	0	...	...
*MZ 8/33	× D. 109, white	do	1	0	...	...
*MZ 8/33	× M. 27/16	do	1	0	...	...
Total ...			5	0	...	...

IV. SELFINGS

M. 23/16	P.E.S.	1	1	...	0
Selangor Seedling	do	1	15	...	0
Total ...		2	16	...	0

* Cane Sorghum hybrids.

RECAPITULATION TABLE

	No. of crosses made		No. of seedlings obtained		No. of seedlings planted						
	C.E.S.	P.E.S.	C.E.S.	P.E.S.	C.E.S.	P.E.S.					
Noble crosses	...	...	30	5	35	6,660	3,583	10,245	2,032	926	2,958
2nd Nobilised Glagah	...	...	0	4	4	0	95	95	0	0	0
3rd Nobilised Glagah	...	...	7	7	14	1,460	686	2,146	519	384	903
4th Nobilised Glagah	...	...	61	66	127	8,137	6,179	14,316	2,730	2,377	5,377
5th Nobilised Glagah	...	...	23	26	49	2,736	7,775	10,511	1,945	1,969	3,914
Other combinations	...	...	55	35	90	28,873	15,148	44,021	4,666	3,300	7,966
Selfings	...	...	0	2	2	...	16	16	...	0	0
Intergeneric crosses	...	...	0	5	5	...	0	0	...	0	0
Total	...	...	176	150	326	47,866	83,484*	81,355	11,892	9,216	21,118

APPENDIX II

Table showing comparison between different methods employed.

	Open Crosses			Bag Crosses			Lantern Crosses		
	No. made	No. obtained seedlings	No. obtained per cross	No. made	No. obtained seedlings	No. obtained per cross	No. made	No. obtained seedlings	No. obtained per cross
C.E.S. ...	115*	41,445	360	28	5,554	198	20	867	43
P.E.S. ...	72	16,507	229	49	10,766	220	29	6,211	214

*Crosses made for abroad not included.

APPENDIX III

TABLES TO SHOW THE PERFORMANCE OF ALL THE RELEASED VARIETIES
IN ALL THEIR TRIALS UP-TO-DATE*Trials with M. 171/30.*

Trial No.	Location	Virgins or Ratoons	Whether irrigated	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent	Standard	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent
3rd Trial	8	P.E.S.	I	63.4	14.4	9.82	BH. 10 (12)	43.9	13.0	5.70
"	11	C.E.S.	I	68.1	15.1	10.27	M. 27/16	55.3	13.6	7.51
Fd. Trial	99	C.E.S.	I	54.9	14.1	7.74	do	44.0	13.4	5.90
"	99	C.E.S.	I	44.5	13.5	6.61	do	35.3	13.2	4.66
"	100	P.E.S.	I	57.3	13.5	7.73	BH. 10 (12)	44.4	14.3	6.35
"	100	P.E.S.	I	28.1	13.0	3.63	do	25.8	14.6	3.78
"	103	P.E.S.	I	54.2	13.7	7.43	do	49.6	15.8	7.85
"	104	C.E.S.	N	50.8	14.2	7.21	M. 27/16	38.0	13.4	5.09
"	105	C.E.S.	I	54.7	14.2	7.76	do	43.0	14.4	6.18
"	106	R/Anguilles	N	47.7	13.5	6.44	BH. 10 (12)	38.2	14.7	5.62
"	107	Britannia	N	46.6	...	...	White Tanna	25.1	...	...
"	108	R/Fund	N	30.0	14.8	4.45	BH. 10 (12)	33.7	14.8	4.99
"	109	Beau Bassin	I	57.9	13.3	7.70	{ do	33.0	13.7	4.53
"	116	{ Mon Désert } { (St. Pierre) }	N	38.9	10.1	3.93	{ DK. 74 } { White Tanna } { BH. 10 (12) }	17.6	10.3	1.81
"								24.7	10.4	2.57

• Average figures for M. 171/30 of 8 trials with BH. 10 (12) as standard:

Tons cane per arpent = 47.2; Tons sucrose per arpent = 6.40.

The same figures for BH. 10 (12) are: —35.4 and 5.00, respectively.

Average figures for M. 171/30 of 5 trials with M. 27/16 as standard:

Tons cane per arpent = 54.6; Tons sucrose per arpent = 7.80.

The same figures for M. 27/16 are: —43.1 and 5.87, respectively.

NOTE.—Trial 116 was reaped at 12 months old and the canes were immature.

Trials with M. 72/31.

Trial No.	Location	Virgins or raatoons	Whether irrigated	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent	Standard cane	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent
3rd Trial	...	...	...	...	...	...	...	...	...	...
"	C.E.S.	Virgins	I	47.5	15.5	7.36	P.O.J. 2878	45.8	16.5	7.55
"	C.E.S.	1st raatoons	I	35.9	15.5	5.98	do	48.2	16.3	7.85
"	P.E.S.	Virgins	I	42.6	17.0	7.25	BH. 10 (12)	36.5	18.2	6.64
"	P.E.S.	1st raatoons	I	53.1	16.6	8.82	do	36.6	16.4	6.00
Fd. Trial	P.E.S.	Virgins	I	53.4	16.9	9.02	do	49.6	15.8	7.85
"	C.E.S.	Virgins	N.I.	51.1	15.7	8.02	M. 27/16	38.0	13.4	5.09
"	C.E.S.	Virgins	I	55.5	15.8	8.80	do	43.0	14.4	6.18
"	R. des Anguilles	Virgins	N.I.	47.2	14.5	6.85	BH. 10 (12)	38.2	14.7	5.62
"	Beau Bassin	Virgins	I	60.6	15.1	9.15	DK. 74	42.7	13.1	5.61
"	Mon Desert	Virgins	I	30.8	10.5	3.23	{ White Tanna	17.6	10.3	1.81
"	(St. Pierre)	Virgins	N.I.	30.8	10.5	3.23	{ BH. 10 (12)	24.7	10.4	2.57

Average figures for M 72/31 of 5 trials with BH. 10 (12) as standard :—tons cane per arpent = 45.4 ; tons sucrose per arpent = 7.03.

The same figures for BH. 10 (12) are 37.1 and 5.73, respectively.

Note.—Trial 116 was reaped when it was 12 months old and the canes were immature.

Trials with M. 73/31.

Trial No.	Location	Virgins or ratoons	Whether irrigated	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent	Standard cane	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent
3rd Trial										
14	C.E.S.	Virgins	I	50.5	15.8	7.98	POJ 2878	45.8	16.5	7.55
14	C.E.S.	1st Ratoons	I	45.9	15.1	6.93	do	48.2	16.3	7.85
22	P.E.S.	Virgins	I	40.6	14.8	6.01	BH. 10 (12)	36.5	18.2	6.64
22	P.E.S.	1st Ratoons	I	57.2	16.0	9.15	do	36.6	16.4	6.00
Fd. Trial										
99	C.E.S.	Virgins	I	53.6	14.4	7.72	M. 27/16	42.3	13.4	5.67
99	C.E.S.	1st Ratoons	I	47.7	14.3	6.84	do	35.3	13.2	4.66
100	P.E.S.	Virgins	I	44.2	13.1	5.79	BH. 10 (12)	44.4	14.3	6.85
100	P.E.S.	1st Ratoons	I	27.6	15.2	4.20	do	25.8	14.6	3.78
103	P.E.S.	Virgins	I	55.5	15.6	8.65	do	49.6	15.3	7.85
104	C.E.S.	Virgins	N.I.	48.0	15.3	7.34	M. 27/16	38.0	13.4	5.09
105	C.E.S.	Virgins	I	52.4	15.1	7.92	do	43.0	14.4	6.18
106	R. des Anguilles	Virgins	N.I.	48.1	13.2	6.35	BH. 10 (12)	38.2	14.7	5.62
107	Britannia	Virgins	N.I.	39.1	"	...	White Tanna	25.1	"	...
108	Rich Fund	Virgins	N.I.	29.3	12.2	3.58	BH. 10 (12)	22.8	13.8	3.14
110	Beau Bassin	Virgins	I	49.1	13.3	6.53	DK. 74	42.7	13.1	5.61
116	Mon Désert	Virgins	N.I.	21.2	9.4	1.99	{ White Tanna BH. 10 (12)	17.6	10.3	1.81
	(St. Pierre)							24.7	10.4	2.57

Average figures for M. 73/31 of S trials with BH. 10 (12) as standard :—tons cane per arpent = 43.0; tons sucrose per arpent = 5.71.

The same figures for BH. 10 (12) are :—34.8 and 5.24, respectively.

Trial No. 116 was reaped when it was 12 months old and the canes were immature.

Trials with M. 134/32

Trial No.	Location	Virgins or ratoons	Whether irrigated	Tons sucrose per arpent	Sucrose % cane	Sucrose tons per arpent	Standard cane	Tons cane per arpent	Sucrose % cane	Sucrose tons per arpent
3rd Trial 21	P.E.S.	Virgins	I	57.5	14.5	8.39	BH. 10 (12)	39.8	15.8	6.29
21	P.E.S.	1st Ratoons	N.I.	63.3	15.2	9.59	do	46.2	15.1	6.96
Fd. Trial 103	P.E.S.	Virgins	I	63.2	17.0	10.77	do	49.6	15.8	7.85
104	C.E.S.	Virgins	N.I.	44.3	16.0	7.09	M. 27/16	38.0	13.4	5.09
105	C.E.S.	Virgins	I	59.1	15.9	9.40	do	43.0	14.4	6.18

Average figures for M. 134/32 of 3 trials with BH. 10 (12) as standard :—

Tons cane per arpent = 61.3, tons sucrose per arpent = 9.58.

The same figures for BH. 10 (12) are :—45.2 and 7.03, respectively.

APPENDIX IV

RESULTS OF VARIETY YIELD TRIALS, REAPED IN 1937

TRIAL 45—ST. ANTOINE S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % cane
POJ. 2727 ...	... 7.41	55.8	13.3	89.4	...
Selangor Seedling ...	... 6.47	49.4	13.1	89.6	...
POJ. 2940 ...	... 4.17	32.3	12.9	88.7	...
D.I. 52 ...	... 3.96	32.4	12.2	85.8	...
S.W. 499 ...	... 3.92	32.0	12.8	89.2	..
B.H. 10 (12) ...	... 3.86	31.9	12.1	87.3	...
SC. 12/4 ...	... 3.56	28.2	12.5	90.1	...
Mean	... 4.76				
S.E. ...	... ± 0.42				
Significant difference	... 1.20				

3rd Ratoons cut: 20.7.1937

Age: 11½ months.

Lay-out:—randomised blocks, without border rows.

Conclusions.—POJ. 2727 and Selangor Seedling were significantly better than B.H. 10 (12), the standard. There was no significant difference between the other varieties and the standard.

TRIAL 73—ST. ANTOINE S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % cane
POJ. 2727 ...	... 4.21	31.7	13.3	93.1	...
Selangor Seedling ...	... 3.85	31.3	12.3	85.4	...
D. 109, white sport ...	... 3.61	28.2	12.8	87.1	...
B.H. 10 (12) ...	... 3.43	26.1	13.1	90.7	...
M. 27/16 ...	... 3.31	29.1	11.4	87.0	...
SC. 12/4 ...	... 2.63	20.6	12.8	89.3	...
Mean	... 3.56				
S. E. ...	... ± 0.22				
Significant difference	... 0.64				

2nd Ratoons cut: 21.7.37.

Age: 11½ months.

Lay-out:—randomised blocks with border rows discarded.

Conclusions.—POJ. 2727 was significantly better than B.H. 10 (12), the standard and SC. 12/4 significantly worse. There was no significant difference between the other varieties and the standard.

TRIAL 74, RICH FUND S. E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane	Purity	Arrows % canes
Selangor Seedling	7.31	40.2	18.2	95.4	...
SW. 499	7.20	43.6	16.5	94.6	...
SC. 12/4	6.28	39.8	15.8	94.2	...
BH. 10 (12)	6.27	35.8	17.4	96.2	...
POJ. 2727	5.97	35.0	17.1	93.5	...
IOJ. 36	5.66	36.1	15.7	93.3	...
POJ. 2940	5.32	30.9	17.2	93.5	...
Mean	6.29	—	—	—	—
S.E.	± 0.24	—	—	—	—
Significant difference	0.69	—	—	—	—

2nd Ratoons cut : 21.9.37. Age : 13 months.

Lay-out :—Randomised blocks without border rows. Not irrigated.

Conclusions.—Selangor seedling and S.W. 499 were significantly better than BH. 10 (12), the standard. There was no significant difference between SC. 12/4, POJ. 2727, POJ. 36 and the standard. POJ. 2940 was significantly inferior to the standard.

TRIAL 75, ST. ANDRÉ S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % Cane	Purity	Arrows % canes
M. 27/16	4.78	33.0	14.5	90.1	...
M. 109/26	4.54	31.3	14.5	88.8	..
M. 14/26	4.18	30.1	13.9	90.9	...
D.K. 74	4.05	27.2	14.9	91.8	..
D. 109, white sport	3.99	27.5	14.5	89.7	...
D. 109	3.34	25.1	13.3	90.3	...
White Tanna Mon Désert	3.34	23.2	14.4	86.7	...
Mean	4.03	—	—	—	—
S.E.	± 0.21	—	—	—	—
Significant difference	0.60	—	—	—	—

2nd Ratoons cut : 28.10.37. Age : 12½ months.

Layout :—Randomised blocks with border rows discarded.

Irrigated.

Conclusions.—M 27/16 was significantly better than M. 14/26, D.K.74, and D.109 white sport; all these as well as M.109/26 were significantly better than the standard, D.109.

TRIAL 76—ST. ANDRÉ S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % cane
Selangor Seedling	...	6.30	40.9	15.4	89.5	...
POJ. 2878	...	5.58	36.7	15.2	91.6	...
POJ. 2727	...	5.29	37.8	14.0	88.9	...
BH. 10(12)	...	4.76	30.1	15.2	92.5	...
R.A. 30	...	4.35	32.2	13.5	89.9	...
55/1182	...	4.16	31.3	13.3	90.7	...
D. 109	...	3.64	24.9	14.6	89.6	...
Mean	...	4.87	—	—	—	—
S.E.	...	± 0.20	—	—	—	—
Significant difference	...	0.59	—	—	—	—

2nd ratoons cut: 28.10.37. Age: 12½ months.

Layout:—Randomised block with border rows discarded.

Irrigated.

Conclusions.—Selangor Seedling was significantly better than all the varieties. The standard, D.109, was significantly superior to all varieties except 55/1182 which showed no significant difference.

TRIAL 78—BEAU CHAMP S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % cane
POJ 2878...	..	5.33	32.5	16.4	89.1	...
BH.10(12)	...	5.29	34.6	15.3	91.1	...
M. 27/16	...	4.60	34.1	13.5	90.1	...
M. 23/16	...	4.13	29.9	13.8	90.2	...
POJ. 2727	...	4.06	29.2	13.9	88.5	...
White Tanna	...	3.69	25.8	14.3	87.5	...
Mean	...	4.52	—	—	—	—
S. E.	...	± 0.24	—	—	—	—
Significant difference	...	0.69	—	—	—	—

2nd ratoons cut; 7.12.37.

Age 12½ months.

Layout:—Randomised blocks, with border rows discarded. Irrigated.

Conclusions:—POJ. 2878, BH. 10 (12) and M. 27/16 were all significantly better than White Tanna, the standard. There was no significant difference between POJ. 2878, BH. 10 (12) both of which were significantly better than M. 27/16

TRIAL 82.—TRIANON S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % cane
M. 5/30	5.86	39.8	14.7	92.6	< 1
M. 13/30	5.68	40.0	14.2	93.0	< 1
M. 10/30	5.60	40.0	14.0	94.8	0
M. 28/30	5.35	36.1	14.8	93.3	0
D.K. 74	4.68	31.0	15.2	95.7	0
Mean	5.43	—	—	—	—
S. E.	±0.19	—	—	—	—
Significant difference	0.56	—	—	—	—

1st Ratoons cut : 7.9.37.

Age : 12.3 months.

Lay-out.—Randomised blocks, with border rows discarded. Not irrigated,

Conclusions.—All the varieties were significantly better than D.K. 74, the standard.

TRIAL 83—GROS BOIS S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 108/30	3.96	27.7	14.3	92.3	...
M. 106/30	3.88	29.1	13.8	93.7	...
POJ. 2878	3.48	22.2	15.7	93.4	...
POJ. 2727	3.46	21.7	15.9	92.3	...
M. 7/23	3.15	20.6	15.3	94.6	...
White Tanna	2.57	17.9	14.4	92.6	...
G. B. No. 2	1.44	10.2	14.2	90.7	...
Mean	3.13	...	...	...	...
S. E.	±0.21	...	...	...	...
Significant difference	0.59	...	...	...	...

1st Ratoons cut : 1.10.37.

Age : 13 months

Layout.—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—M. 108/30, M. 106/30, POJ. 2878, POJ. 2727 were significantly better than White Tanna, the standard. G. B. No. 2 was significantly inferior to the standard. There was no significant difference between M. 7/23 and White Tanna.

TRIAL 94, LABOURDONNAIS S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
Selangor Seedling	...	7.87	52.1	15.1	95.9	...
POJ. 2727	...	7.65	56.7	13.5	93.4	...
BH. 10 (12)	...	7.09	46.6	15.2	94.9	...
SC. 12/4 ...	...	6.38	45.6	14.0	94.3	...
M. 29/16	...	6.33	50.7	12.5	91.8	...
S.W. 499 ...	...	5.76	44.7	12.9	88.9	...
M. 13/18 ...	...	5.21	41.7	12.5	93.9	...
Mean	...	6.61	...	...	...	...
S.E.	...	±0.28	...	...	...	...
Significant difference	...	0.80	...	...	...	...

1st Ratoons cut: 12-13.8.37. Age: 12 months.

Lay-out—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions.—There was no significant difference between Selangor Seedling, SC. 12/4, M. 29/16, POJ. 2727 and BH. 10 (12), the standard. S.W. 499 and M. 13/18 were significantly inferior to the standard.

TRIAL 95, LABOURDONNAIS S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
POJ. 2727	...	6.61	45.3	14.6	95.6	...
Selangor Seedling	...	6.17	41.2	15.0	95.3	...
BH. 10 (12)	...	5.86	38.6	15.2	95.8	...
M. 29/16	...	5.70	43.2	13.2	92.2	...
SC. 12/4	...	5.48	38.6	14.2	94.6	...
M. 13/18	...	5.19	39.1	13.3	93.9	...
S. W. 499	...	4.93	32.2	15.3	93.4	...
Mean	...	5.70	...	...	...	...
S.E.	...	±0.38	...	...	...	...
Significant difference	...	0.96	...	...	...	...

1st Ratoons cut: 13-14.8.37. Age: 12 months.

Lay-out.—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions.—There was no significant difference between any of the varieties and BH. 10 (12), the standard.

TRIAL 97, MON DESERT AND MON TRESOR S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
POJ. 2878	...	8.11	50.0	16.2	92.1	...
Selangor Seedling	...	7.14	43.0	16.6	91.1	...
BH. 10 (12)	...	6.71	41.4	16.2	91.6	...
POJ. 2727	...	6.60	45.9	14.4	88.7	...
SC. 12/4 ...	...	5.93	36.9	16.1	92.1	...
S.W. 499 ...	...	4.77	31.0	15.4	91.1	...
Mean	...	6.54	...	...	...	...
S.E.	...	± 0.23	...	...	...	...
Significant difference	...	0.67	...	...	...	...

1st Ratoons cut: 23.9.37. Age: 11 months.

Lay-out.—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—POJ. 2878 was the only variety significantly better than the standard, BH. 10 (12). There was no significant difference between Selangor Seedling, POJ. 2727 and the standard. SC. 12/4 and S.W. 499 were significantly inferior to the standard.

TRIAL 98—RICH FUND S.E.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
Selangor Seedling	...	6.54	40.6	16.1	94.6	...
POJ. 2727	...	6.00	37.5	16.0	94.9	...
BH. 10 (12)	...	4.55	33.2	13.7	90.5	...
S.C. 12/4...	...	4.49	30.1	14.9	93.2	...
POJ. 36 ...	...	4.12	30.8	13.4	92.2	...
Mean	...	5.14	...	...	...	...
S.E.	...	± 0.37	...	...	...	..
Significant difference	...	1.10	...	..	...	...

1st Ratoons cut: 23.9.37. Age: 10 months.

Lay-out.—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions.—Selangor Seedling and POJ. 2727 were both significantly better than BH. 10 (12), the standard. There was no significant difference between SC. 12/4, POJ. 36 and the standard.

TRIAL 99—C.E.S. (REDUIT).

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 73/31 ...	...	6.84	47.7	14.3	88.1	...
M. 171/30	...	6.01	44.5	13.5	88.0	...
M. 27/16 ...	..	4.66	35.3	13.2	90.2	...
M. 163/30	...	4.08	33.9	11.9	85.5	...
M. 186/30	...	3.99	33.4	11.8	83.2	...
Mean	...	5.12	...	...	...	...
S.E.	...	±0.20	...	...	...	...
Significant difference	...	0.58	...	...	...	...

1st Ratoons cut: 15.11.37. Age: 11.3 months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M. 73/31 and M. 171/30 were both significantly better than M. 27/16, the standard. There was no significant difference between M. 163/30 and the standard. M. 73/31 was itself significantly superior to M. 171/30. M. 186/30 was significantly inferior to the standard.

TRIAL 100, P.E.S.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 73/31 ...	...	6.37	41.8	15.2	91.3	...
BH. 10 (12)	...	5.68	38.8	14.6	91.3	...
M. 171/30	...	5.49	42.4	13.1	89.5	...
M. 186/30	...	4.50	37.0	12.2	88.1	...
M. 113/30	...	4.45	36.0	12.4	88.2	...
M. 163/30	...	3.84	32.0	12.0	87.9	...
Mean	...	5.05	...	...	...	...
S.E.	...	±0.17	...	...	...	...
Significant difference	...	0.51	...	...	...	...

1st Ratoons cut: 6.12.37. Age: 12 months.

Lay-out.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M. 73/31 was significantly better than the standard, BH. 10 (12). M. 186/30, M. 113/30 and M. 163/30 were significantly inferior to the standard. There was no significant difference between the standard and M. 171/30.

TRIAL 102, C.E.S. (RÉDUIT)

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 151/30	...	6.84	48.5	14.1	92.7	...
M. 27/16 ...	...	6.15	47.7	12.9	92.0	...
Mean	...	6.49	...	...	...	...

Virgins. Cut: 8.9.37. Age, 21 months. Irrigated.

Conclusions.—This trial has been discarded, M. 151/30 having objectionable characteristics.

TRIAL 103, P.E.S.

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 134/32	...	10.77	63.2	17.0	94.6	<1
M. 72/31 ...	...	9.02	53.4	16.9	92.8	0
M. 73/31 ...	...	8.65	55.5	15.6	90.4	0
M. 10/30 ...	...	7.89	54.0	14.6	92.7	0
B.H.10 (12)	...	7.86	49.6	15.8	91.4	0
M. 5/30 ...	...	7.63	52.4	14.6	92.6	0
M. 171/30	...	7.43	54.3	13.7	90.3	0
M. 13/30 ...	...	6.84	47.2	14.5	91.0	0
Mean	...	8.26	...	...	...	...
S.E.	...	±0.24	...	...	...	...
Significant difference	...	0.73	...	...	...	...

Virgins. Cut: 11.10.37 Age: 11½ months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M. 134/32 was significantly better than M. 72/31 and M. 73/31 and all three were significantly better than the standard, B.H. 10 (12). M. 13/30 was significantly inferior to the standard. There was no significant difference between the standard and M. 10/30, M. 5/30 and M. 171/30.

TRIAL 104—C.E.S. (REDUIT)

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 72/31 ...	...	8.02	51.1	15.7	89.1	0
M. 73/31 ...	...	7.34	48.0	15.3	90.0	0
M. 171/30	...	7.21	50.8	14.2	88.5	0
M. 134/32	...	7.09	44.3	16.0	90.9	13
M. 5/30 ...	...	5.92	44.5	13.3	84.6	0
M. 10/30 ...	...	5.58	37.7	14.8	90.2	0
M. 27/16 ...	...	5.09	38.0	13.4	87.8	0
M. 13/30 ...	...	5.03	35.7	14.1	88.6	0
Mean	...	6.41	...	...	...	...
S.E.	...	±0.52	...	...	...	...
Significant difference	...	1.54	...	...	...	...

Virgins. Cut: 20.12.37. Age: 16½ months.

Layout.—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions—M. 72/31, M. 73/31, M. 171/30 and M. 134/32 were all significantly better than M. 27/16, the standard. There was no significant difference between the other varieties and the standard, and also no significant difference between M. 72/31, M. 73/31, M. 171/30 and M. 134/32.

TRIAL 105—C.E.S. (REDUIT).

Variety		Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 134/32	...	9.40	59.1	15.9	91.7	3
M. 72/31 ...	...	8.80	55.5	15.8	91.2	...
M. 73/31 ...	...	7.92	52.4	15.1	90.4	...
M. 171/30	...	7.76	54.7	14.2	87.4	...
M. 10/30 ...	...	7.85	50.0	14.7	92.0	...
M. 5/30 ...	...	6.67	49.8	13.4	85.3	...
M. 13/30 ...	...	6.29	45.5	13.8	88.8	...
M. 27/16 ...	...	6.18	43.0	14.4	92.2	<1
Mean	...	7.54	...	...	...	...
S.E.	...	±0.437	...	...	...	...
Significant difference	...	1.28	...	...	...	...

Virgins. Cut: 26.10.37. Age: 14½ months.

Layout.—Randomised blocks, with border rows discarded. Irrigated.

Conclusions.—M. 134/32, M. 72/31, M. 73/31, and M. 171/30 were significantly better than M. 27/16, the standard. There was no significant difference between the other varieties and the standard. There was no significant difference between M. 134/32 and M. 72/31, but M. 134/32 was better than all the other varieties.

TRIAL 106—RIVIÈRE DES ANGUILLES S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 72/31 ...	6.85	47.2	14.5	88.7	...
M. 171/30	6.44	47.7	13.5	88.1	...
M. 73/31...	6.35	48.1	13.2	88.9	...
B.H. 10 (12)	5.62	38.2	14.7	90.2	...
R.A. 4/24...	5.40	43.8	12.5	83.4	...
Mean ...	6.12	...	...	...	...
S.E. ...	± 0.30	...	...	...	...
Significant difference ...	0.91	...	...	...	...

Virgins. Cut: 19.10.37. Age: 14 months.

Layout.—Randomised blocks with border rows discarded. Not irrigated.

Conclusions.—M. 72/31 was the only variety significantly better than B.H. 10 (12), the standard. There was no significant difference between the other varieties and the standard.

TRIAL 107—BRITANNIA S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
R.A. 4/24	...	48.9	...	...	...
M. 171/30	...	46.6	...	...	...
M. 73/31 ...	...	39.1	...	...	...
S.C. 12/4 ...	...	35.8	...	...	...
White Tanna	...	25.1	...	...	...
Mean ...	...	38.9	...	...	...
S.E. ...	...	± 2.94	...	...	...
Significant difference ...	...	9.1	...	...	...

Virgins. Cut: 11.1.38. Age: 16½ months.

Layout.—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions.—All the canes in this trial were significantly better than White Tanna, the standard. There was no significant difference between R.A. 4/24 and M. 171/30. The canes in this trial were not analysed as they were not ripe.

TRIAL 108—RICH FUND S.E.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 171/30	4.45	30.0	14.8	92.0	...
M. 73/31 ...	3.58	29.3	12.2	86.5	...
B.H. 10 (12)	3.14	22.8	13.8	92.6	...
Mean ...	3.72	...	...	...	...
S.E. ...	±0.16	...	...	...	...
Significant difference ...	0.51	...	...	...	...

Virgins. Cut: 24.9.37. Age 12½ months.

Layout.—Randomised blocks, with border rows discarded. Not irrigated

Conclusions.—M. 171/30 was significantly better than B.H. 10 (12), the standard. There was no significant difference between M. 73/31 and the standard.

TRIAL 100—BEAU BASSIN

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 171/30	7.70	57.9	13.3	87.5	...
B.H. 10 (12)	4.99	33.7	14.8	90.2	...
D.K. 74 ...	4.53	33.0	13.7	92.1	...
131 P ...	2.84	23.3	12.2	86.9	...
Mean ...	5.00	...	...	...	...
S.E. ...	±0.37	...	...	...	...
Significant difference ...	1.13	...	...	...	...

Virgins. Cut: 4.11.37. Age 13½ months.

Layout.—Randomised blocks, with border rows discarded. Irrigated.

Conclusions.—M. 171/30 was significantly better than D.K. 74, the standard. There was no significant difference between B.H. 10 (12) and D.K. 74. 131 P. was significantly inferior to the standard.

TRIAL 110—BEAU BASSIN

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 72/31 ...	9.13	60.6	15.1	89.8	...
M. 73/31 ...	6.53	49.1	13.3	87.4	...
D.K. 74 ...	5.61	42.7	13.1	90.8	...
Mean ...	7.09	...	...	...	...

Virgins. Cut: 4.11.37. Age: 13½ months.

Layout.—Randomised blocks, with border rows discarded. Irrigated.

Conclusions.—The results of this trial could not be analysed statistically owing to some missing plots.

TRIAL 111—P.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 140/31...	9.33	59.3	15.7	89.3	...
M. 156/31 ..	8.72	63.2	13.8	86.8	...
BH. 10 (12)	7.55	47.7	15.8	89.4	...
Mean	8.53	...	...	...	...
S.E.	±0.27	...	...	...	...
Significant difference	0.85	...	...	...	...

Virgins. Cut: 21.12.37. Age: 14½ months.

Layout.—Randomised blocks, with border rows discarded. Irrigated.

Conclusions.—M. 140/31 and M. 156/31 were both significantly better than the standard, BH. 10 (12).

TRIAL 112—P.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 108/32...	8.87	65.0	13.6	85.9	...
M. 108/30...	8.09	55.9	14.5	86.7	...
BH. 10 (12)	8.00	48.1	16.6	92.9	...
M. 196/31...	7.26	57.9	12.5	82.8	..
M. 9/31 ...	7.18	53.2	13.5	85.0	...
M. 48/30 ...	6.68	47.1	14.2	90.6	...
Mean	7.68	...	...	...	...
S.E.	±0.40	...	...	...	...
Significant difference	1.20	...	...	...	...

Virgins. Cut: 20.10.37. Age: 12¼ months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—M. 48/30 was significantly inferior to the standard, BH. 10 (12). There was no significant difference between all the other varieties and the standard.

TRIAL 113, C.E.S. (RÉDUIT)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 108/30	6.61	49.3	13.4	81.6	0
M. 196/31	6.22	48.9	12.7	85.1	3
M. 62/32 ...	5.94	44.0	13.5	83.6	0
BH. 10 (12)	5.90	36.7	16.1	83.8	...
M. 48/30 ...	5.63	38.0	14.8	88.7	...
M. 71/30 ...	5.35	36.7	14.6	92.5	...
Mean	5.94	...	...	...	...
S.E.	±0.18	...	...	...	...
Significant difference	0.53	...	...	...	...

Virgins. Cut: 16.11.37. Age: 13.3 months.

Layout.—Randomised blocks, with border rows discarded. Irrigated.

Conclusions.—M. 108/30 was the only variety significantly better than BH. 10 (12), the standard. There was no significant difference between the other varieties and the standard, except M. 71/30, which was significantly inferior.

TRIAL 114—P.E.S.

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 20/32	7.43	49.9	14.9	89.4	35
BH. 10 (12)	6.52	39.8	16.4	89.7	...
M. 71/30	5.65	44.2	12.8	83.6	...
Mean	6.53	...	...	...	...
S.E.	±0.45	...	...	...	...
Significant difference ...	1.56	...	...	...	...

Virgins. Cut: 21.12.37. Age: 14 months.

Layout.—Randomised blocks with border rows discarded. Irrigated.

Conclusions.—There was no significant difference between the standard, BH. 10 (12) and the two other varieties.

TRIAL 116—MON DÉSERT (ST. PIERRE)

Variety	Sucrose tons per arpent	Cane tons per arpent	Sucrose % cane	Purity	Arrows % canes
M. 171/30	3.93	38.9	10.1	75.9	...
M. 72/31	3.23	30.8	10.5	76.0	...
BH. 10 (12)	2.57	24.7	10.4	76.4	...
M. 73/31	1.99	21.2	9.4	76.1	...
White Tanna	1.81	17.6	10.3	74.1	...
Mean	2.71	...	...	...	...
S.E.	±0.18	...	...	...	...
Significant difference ...	0.58	...	...	...	...

Virgins. Cut: 21.12.37. Age: 12½ months.

Layout.—Randomised blocks, with border rows discarded. Not irrigated.

Conclusions.—M. 171/30, M. 72/31 and BH. 10 (12) were all significantly better than the standard, White Tanna. There was no significant difference between M. 73/31 and White Tanna. M. 171/30 and M. 72/31 were both significantly better than BH. 10 (12), and M. 171/30 was itself significantly better than M. 72/31. This trial was very immature at the time of cutting and this is the reason for the low sucrose contents.

PART II—CHEMISTRY

BY N. CRAIG

As mentioned previously, the Senior Chemist—formerly styled Bio-Chemist—was appointed Acting Geneticist and was placed in charge of the Station. Consequently the only officer constantly engaged in the practical work in this division was my Scientific Assistant, with the result that the amount of work performed is less than in former years, but satisfactory progress has been made in some branches of the work. The different investigations are briefly described in the following pages.

New Analytical Methods.—With the object of obtaining simpler analytical methods for soil advisory work, some new methods of determining the available plant food in the soil have been tested against the methods previously employed in the soil survey work. The determinations which have come within the scope of this work are:—pH value, available potash and available phosphate.

pH Value of soils.—It was realised before the Senior Chemist went on leave in 1936, that in some cases the collodion bag method seemed to give results with certain soils which were not correct. Consequently twelve samples were submitted to two agricultural stations for pH determinations by various methods, namely the Glass Electrode, Quinhydrone Electrode, and Kuhn's Colorimetric Method. Moreover, on the author's return from Europe the Kuhn method was tried here, and the results obtained are given below. At the same time, Kuhn's method was tried with six soils representative of the different Java types, the pH values of which had been determined by electrometric methods in Java.

pH VALUES OF SOME MAURITIUS AND JAVA SOILS BY DIFFERENT METHODS

	ENGLAND			JAVA	MAURITIUS	
	Glass electrode	Quinhydrone electrode	Kuhn's Colorimetric	Hydrogen (?) Electrode	Collodion bag	Kuhn's Colorimetric
P. 6						
a 0-6 ins. ...	6.14	6.32	6.1	...	6.4	6.2
b 6-29 „ ...	6.14	6.32	6.2	...	6.5	6.0
c 29-36 „ ...	6.25	6.62	6.3	...	6.6	6.2
d 36-48 „ ..	6.33	6.63	6.3	...	6.6	6.2
P. 7						
a 0-8 ins. ...	5.58	5.87	5.6	...	5.8	5.7
b 8-21 „ ...	5.82	5.99	5.7	...	6.1	5.8
c 24-36 „ ...	6.17	6.30	6.1	...	6.0	6.0
d 36-48 „ ...	6.17	6.26	6.1	...	6.3	5.9
P. 8						
a 0-10 ins. ...	5.55	5.34	5.7	...	5.9	5.6
b 10-24 „ ...	5.66	5.58	5.7	...	6.1	5.8
c 24-36 „ ...	5.80	5.89	5.8	...	6.4	5.3
d 36-48 „ ...	5.82	6.06	5.8	...	6.2	5.8
Java						
30279 ...	...	...	...	4.7	...	4.8
30281 ...	...	...	...	6.9	...	6.9
30283 ...	...	...	...	5.6	...	5.6
33193 ...	...	...	...	6.6	...	6.6
33194 ...	...	...	...	5.1	...	5.4
33195 ...	...	...	...	6.9	...	6.8

Kuhn's method was further tested against a series of normal Mauritius soils, covering the whole range and the differences between Kuhn's Method and the Collodion Bag Method were negligible and consequently in future work it is proposed to use Kuhn's Method, due to its greater reliability and rapidity.

The determinations in England were performed at Rothamsted Experimental Station and at Armstrong College, Newcastle-upon-Tyne, and I have much pleasure in acknowledging the help received from both these institutions.

Available Potash.—The method of determining the exchangeable potash by leaching with ammonium acetate is in practice rather cumbersome, and upon sugar estates where the laboratory water supply may be very inefficient it is often impracticable. Consequently the Volk-Truog method was tried, and it was found that two successive five minute extractions using 225 mls. of normal ammonium acetate solution for each extraction to each 30 grs. of soil was found to extract 98% of the total exchangeable potash, whereas by using double the quantity for one extraction of five minutes extracted only 82%. This method can be carried out even in laboratories where there is no water supply to operate a vacuum pump for leaching the soil. In view of the results obtained it is suggested that the former method extracting 98% of the total exchangeable potash from soils should be adopted for the determination of exchangeable potash in Mauritius soils.

Available Phosphoric Oxide.—In the Annual Report for 1936, a short account was given of the results obtained by extracting available phosphorus from soils by hot 1% potassium carbonate solutions, by the method of Whitney and Gardner. The results obtained in this investigation showed that the availability of soil phosphorus was dependent to a certain extent upon the pH value of the soil, high acidities being associated with an unavailable condition of the soil phosphorus. These results agree with those published in the Empire Journal of Experimental Agriculture (January 1937), wherein some figures obtained by the method of Truog and Dean were published.

This method by alkaline extraction is not suitable, however, for use in an estate laboratory, Truog's method being much more suitable in the hands of a careful worker. One big disadvantage about this method, however, is the fact that very low results are obtained with the highly laterised, immature soils rich in organic matter, whereas Dyer's Citric acid method shows a medium available P_2O_5 content. It has been shown that this is due to phosphorus in the organic form, which is unaffected by the 0.002N sulphuric acid as used in Truog's Method. Furthermore, there is some evidence that this phosphorus in the organic form is of some value to the growing plant. Consequently, Truog's Method must be regarded as unreliable for soils of this nature. In order to try to find a method which would be equally reliable for all the normal cultivated soils, the Rapid Chemical Method described by F. Hance in the Hawaiian Planters' Record was tried. This method is essentially one designed for advisory work, so that the soils are split into three groups: low phosphate content, medium and high. This method has been found to be of value in Hawaii, and as the soils there may in some respects be similar to those in Mauritius, it was thought that the method might be adopted with advantage here.

A brief description of the method as adopted is as follows: 10 grams of soil is extracted with 30 mls of N/2 hydrochloric acid for 30 seconds and then filtered. 10 ccs of the filtrate is pipetted into a 50 mls pyrex beaker and evaporated to dryness after addition of 10 drops of nitric acid on a sand bath

at a low temperature, in order to destroy organic matter. When dry, 10 drops of concentrated HCl and 10 drops of HNO_3 are added, and once again evaporated to dryness. If the residue is still discoloured by organic matter this operation is repeated, and a final evaporation with 10 drops of hydrochloric acid is made. Care is taken during these various evaporations not to bake the residue by heating to too high a temperature. The residue is allowed to cool, and is then dissolved by 10 mls of a reagent consisting of hydrochloric acid containing ammonium molybdate, and the solution placed in standard test tubes and stannous chloride is then added drop by drop until maximum colour intensity is obtained. The colour is then compared to permanent colour standards made from inorganic chemicals, corresponding to low, medium and high phosphate contents.

This method has been tried with soils already examined by different methods, and the following conclusions were reached. In general, the method gave results of a similar order to other methods employing weak acid extraction methods, in the placing of the soils in various groups, i.e. low, medium and high P_2O_5 groups. It has already been shown that the Dyer and Truog methods gave comparable results, except in immature soils of high organic content, the latter method giving much lower figures, which probably reflected the phosphate status of the soil incorrectly. The Rapid Chemical Method, however, showed these soils to fall within the range of medium available P_2O_5 contents as does Dyer's method, and consequently this method would appear to be more generally applicable to the normal cultivated soils in Mauritius. In addition, the Rapid Chemical Method of Hance has advantages over Dyer's method, in that it is easier and quicker in operation so that more detailed studies of the soils of an estate can be made by this method.

The results obtained so far confirm the results from other methods, that in acid soils, where the proportion of organic matter is not high the amount of available phosphate is low, even if they contain a comparatively high total P_2O_5 content. It would appear, therefore, that to raise the phosphate status of these acid soils to a more satisfactory level, the pH value should first of all be raised by means of applications of liming materials such as coral sand in order that subsequent applications of phosphate may remain in a more available condition. At the present, it is considered that if the pH value of the soil is above 6.0 then the phosphate may remain in a condition available for plant growth.

Soils at Lallmatie, Bon Accueil, etc.—As mentioned earlier in this report, an investigation was carried out with respect to the soils in the neighbourhood of Lallmatie where the principal sugar cane varieties grown are two clones which are seedlings of the Uba cane produced at Rich Fund S.E. The area under these sugar cane varieties was roughly surveyed and it was found that it coincided with a special soil formation which had not been previously examined. The area extends roughly from St Julien to the Rivière du Rempart running in a North Easterly direction; it would appear that it finally merges into the Plaine des Roches.

It would appear that the soils in this area are derived from a comparatively recent lava flow, and consequently the soils are extremely shallow. The underlying rock is of a very porous nature and it may be cavernous. In consequence of this porous condition, it is probable that drainage is fairly good, and this agrees with information received from the Indian cultivators who till this soil.

The soil itself has a good structure, but is extremely shallow. In some places it may reach to a depth of 8 inches, with possibly a layer of subsoil 2 or 3 inches thick. In others there may be as little as 4 or 5 inches of top soil, with practically no subsoil, but an almost immediate transition to the partially weathered parent rock. This is probably one of the reasons why such poor crops with the better cane varieties are obtained in this locality.

Another area where these same cane varieties are cultivated to a certain extent is near St. Julien d'Hotman, but here the soils are very different from those previously described. These soils are rocky soils of the type encountered at Rich Fund S E., but because of their situation they are likely to be more highly laterised, and consequently poorer in plant food constituents. Also they are not situated so favourably with respect to climatic conditions.

There is a still further area at Solferino near Vacoas, where small cultivators grow quite a fair proportion of Uba Rich Fund canes. Again, in this locality, the soils are extremely shallow, and are underlain by a porous rock formation. In addition, this area is situated in a moderately dry situation, so that the crop is very liable to suffer from drought.

Soil samples have been taken from all these areas and the following results have been obtained :—

ANALYTICAL RESULTS OBTAINED WITH SOILS FROM LALLMATIE, ETC

Results expressed % oven dry soil

Locality	H ₂ O when air dry	Org. Mat- ter	Nit- rog- en	C/N ratio	pH	Comb- ined H ₂ O	Available P ₂ O ₅			Exch K ₂ O.
							Pot. Carb. method	R.C.M.	Truog	
Lallmatie ...	17.8	20.5	1.04	11.4	5.7	16.6	0.022	D	Nil	0.004
Bon Accueil ...	16.4	16.2	0.86	11.0	6.0	15.3	0.022	D	Nil	0.008
St. Julien, d'Hotman	11.9	8.7	0.49	10.3	5.4	15.2	0.028	D	0.0004	0.008
Solferino ...	10.4	6.7	0.35	11.1	5.9	11.7	...	D	0.0004	0.005

One point which stands out prominently from these results is the organic nature of the soils from Lallmatie and Bon Accueil. Although immature soils in the high rainfall districts have been encountered with as much as 10% organic matter content, a percentage of 20.5, or even 16.4 has never previously been seen except in definitely marshy conditions. It would appear that organic matter tends to accumulate in immature soils situated in fairly wet conditions. In the present cases, this accumulation may be accentuated because of the small volume of soil per arpent, together with the fact that the residues from the previous crop are always buried in the soil. The carbon : nitrogen ratios—approximately 11.0—indicate that this soil organic matter has a normal constitution and as a result the total nitrogen reserve in these soils is high. This high organic matter will have important effects upon other soil properties, especially the water holding capacity and the total base exchange capacity.

The water holding capacity of these soils will be much greater, weight for weight, than those soils with a much lower content of organic matter, and this must be an important point in such shallow soils, where susceptibility to drought is greater than in deeper soils situated in similar climatic conditions. Furthermore, it has already been shown that the total base exchange

capacity of normal soil organic matter in Mauritius remains constant in the different soils, with a value of about 250 mgr.eqs. %. Consequently the base exchange capacity of these soils is undoubtedly high, and moreover although the pH values are on the low side, there will still be a fairly high proportion of exchangeable bases. The amount of potash, however, is extremely low, and because of the high base exchange capacity of these soils, there will be increased competition with the plant for this small amount of potash. It would appear, therefore, that liberal applications of potash fertilisers in these soils is necessary. The amount of available phosphate by both the potassium carbonate method and the rapid chemical method lies within the medium zone, but much of this phosphate is probably linked up with the organic matter. As mentioned earlier, there appears a tendency for organic matter to accumulate, and consequently the value of the phosphate in association with it would appear to be low.

One of the chief difficulties in this area is the small volume of soil per arpent; this difficulty is accentuated if the weight per arpent is considered as the volume weight of this soil will probably be very low because of its high organic matter content.

The soils from St. Julien d'Hotman and Solferino are more normal, and call for no very special comments. The organic matter, Nitrogen, C/N ratio and combined moisture contents fall within the limits already obtained in the general survey. The former has an extremely low pH value, and probably the application of coral sand would bring about an improvement. In both cases the content of exchangeable potash is extremely low and liberal applications of potash fertilisers are required. In the case of St. Julien d'Hotman, the phosphate status is doubtful, but probably applications of phosphatic fertilisers would be profitable at Solferino.

FOLIAR DIAGNOSIS

In the past attempts to determine plant food deficiencies in the soil were made by means of analysis of the juice expressed from sugar cane. These efforts were not successful and consequently this method was abandoned. Subsequently in 1936, the method of leaf analysis, as practised by Lagatu and Maume with the vine, potatoes and tobacco was tried, and in order to deal with leaves of the same physiological age, the third leaf blade from the top was chosen. The results obtained in the preliminary series were encouraging, and consequently further series of analysis with material derived from different manurial trials have been made.

In the case of two trials at the Central Experiment Station, Réduit, leaf samples were taken from two classes of cane in each plot i.e. from (a) big canes, (b) shoots not yet showing any cane. These two classes are from shoots of different physiological ages, and the analyses show whether the results from the two classes are the same or not.

In another trial—Bio. 9, Cascale, Rose Belle S.E.—there are plots of both White Tanna and B.H. 10 (12) in this trial and samples were taken from each variety, so that these analyses should show the variation which may be expected because of varietal differences. In all cases, the effect of differential fertilisation upon the composition of the leaf is shown.

Trial Bio. 5, Central Experiment Station.—This trial contains three treatments in which plots which received either no phosphate or no potash were compared with plots which received complete fertilisers. The total plant food content expressed as a percentage of the dry matter in the leaf is given for both the virgin crop, and the first ratoon crop, together with the proportion of each plant food constituent.

LEAF ANALYSIS, BIO 5, C.E.S.

VIRGIN CROP 1936					1ST RATOON CROP 1937				
	Total plant food content	Amount of each plant food expressed as % of the total			Total plant food content	Amount of each plant food expressed as % of the total			
		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O	
Complete ...	3.08	49.7	11.7	38.6	3.35	52.0	10.3	37.7	
No P ₂ O ₅ ...	3.29	46.5	9.7	43.8	3.31	49.8	8.8	41.3	
No K ₂ O ...	2.83	55.1	12.4	32.5	2.71	59.4	12.5	28.1	

It will be seen that in both years, the plant food constituents in the leaf is considerably reduced in the no potash plots, due to the reduced intake of potash. Again, the relative proportions of the three major constituents vary in a similar way in each crop, the omission of either K₂O or P₂O₅ from the fertiliser mixture being immediately apparent in the analytical results. A further point which may be of great importance, there is a fall in the relative proportion of P₂O₅ in the no P₂O₅ plot from the virgin crop to the first ratoon crop, and also of K₂O from the no potash plot at the same time. This may be accounted for by the exhaustion of the reserve of available phosphoric acid and exchangeable potash which was present in the soil at the start of the experiment. Should this be actually the case, then the effect of omitting either of the elements from the fertiliser programme should be more marked in the first ratoon crop to be reaped in 1938 than in the virgin crop in 1937.

Trial Bio. 9, Cascade, Rose Belle S.E.—In this trial there are three manurial treatments (a) complete, (b) no phosphate fertilisers, (c) no potash fertilisers. Each plot contains two varieties of cane White Tanna and BH. 10 (12). Although this trial is only due to be reaped in the coming crop season, it can safely be stated that there will be definite responses to both phosphate and potash fertilisers, especially the latter, as it seems possible that practically no crop will be reaped from the plots receiving no potash.

Samples of the leaves were taken from the different plots and submitted to analysis, the following results being obtained.

ANALYSIS OF LEAVES FROM TRIAL BIO. 9, CASCADE, ROSE BELLE S.E.

	WHITE TANNA				BH. 10 (12)			
	Total nutrient content	Amount of each nutrient expressed as % of the total			Total nutrient content	Amount of each nutrient expressed as % of the total		
		N	P ₂ O ₅	K ₂ O		N	P ₂ O ₅	K ₂ O
Complete fertilisers ...	2.55	51.4	14.1	34.5	2.53	55.7	14.2	30.1
No phosphate..	2.50	52.8	12.0	35.2	2.37	57.8	13.5	28.7
No potash ...	2.39	62.1	17.1	20.8	2.35	66.4	17.5	16.2

It will be noticed that the figures given in this table vary in several respects from those given in the previous one, the chief differences lying in the the total nutrient content of the leaves and in the relative proportions of the various nutrients. In trial Bio. 5, the total plant food of the complete fertiliser plots is about 3.1%, whereas in this trial with BH 10 (12) the figure was 2.5%. This reduction is due chiefly to the much smaller quantity of potash, but is also in part due to the nitrogen, the absolute

amount of phosphate in the two trials being the same. The cause for this lack of nutrients in the leaf is probably connected with the poverty of the soil in this experimental field, which is situated in a very highly laterised mature soil. In field trials where the yield of cane has been satisfactory, the ratio of the different plant nutrients has been in the neighbourhood of $N : P_2O_5 : K_2O = 50 : 12 : 38$, which figures are provisionally adopted for the optimum ratio. It would appear, therefore, that in trial Bio. 9, even in the plots receiving complete artificials, the balance is still not ideal for maximum cane production, as the ratio for BH. 10 (12) is 55.7/14.2/30.1, a more unbalanced ratio than in the no-potash plot of trial Bio. 5, virgin crop. It would appear therefore that the potash fertiliser should have been increased in the complete fertiliser plots. Consequently from the result of leaf analysis, this soil would appear to be lacking in plant nutrients generally and that the ratio is not at all satisfactory.

The comparison between White Tanna and BH. 10 (12) in this plot is interesting, the variation between the different treated plots being reflected similarly by the analysis of the leaves from each variety. It will be seen, however, that the proportion of nitrogen is always somewhat lower and that of potash somewhat higher in White Tanna than in BH. 10 (12), inferring that the former variety is better adapted for growth in these extremely poor soils. Actually when the leaves were sampled in December 1937, the no-potash plots of BH. 10 (12) seemed to be suffering more acutely from lack of potash than did those of White Tanna. The total plant food constituents and the phosphate content of the leaves were approximately the same in both varieties. In this connection, it is interesting to note that the juice of White Tanna canes generally contain much more P_2O_5 than do BH. 10 (12) canes grown in similar conditions.

Trial 69, Central Experiment Station, Réduit.—This trial was sampled twice during the year, once fairly late in the growth of the 2nd crop, and the other early in the growth of the 3rd ratoon crop. There are only two treatments in this trial, one series of plots receiving four times as much plant food as the other. The average difference in yield for the first three crops is nearly 15 tons per arpent in favour of the heavily fertilised plots.

ANALYSIS OF LEAVES FROM TRIAL 69, CENTRAL EXPERIMENT STATION, RÉDUIT.

	2ND RATOONS 1937				3RD RATOONS 1937			
	Total nutrient content	Amount of each nutrient expressed as a % of the total			Total nutrient content	Amount of each nutrient expressed as a % of the total		
		N	P_2O_5	K_2O		N	P_2O_5	K_2O
Heavily ferti- lised plots...	2.96	48.3	11.1	40.6	3.18	52.5	10.4	37.1
Low fertilised plots ...	2.50	53.6	13.6	32.8	2.75	60.0	13.5	26.5

In both crops the total nutrient content is considerably increased by the heavy applications, and the changes in the relative proportions have in each case been in a similar direction. There are some differences between the analytical results with the samples from 2nd and 3rd ratoon crops, but this may be accounted for at least in part, by the fact that the leaf samples from the former were taken late in the crop, after all the fertilisers had been applied, whereas in the latter, the samples were taken early, when only part of the

fertiliser had been given. In addition to the increased uptake of plant food constituents, the heavy applications of fertilisers also seems to have corrected a potash deficiency, in that it has raised the proportion of K_2O from 32.8% and 26.5% to 40.6% and 37.1%, respectively.

Although the comparison cannot be made with any great exactitude, it is interesting to note that the results from 3rd ratoons in this trial (heavy fertiliser plots) and those from trial Bio. 5 first ratoons (complete fertiliser plots) agree very closely. These trials lie side by side and the treatments are similar, so it might appear that these two varieties are comparable in their demands.

Leaf samples were also analysed from the subsoil experiment (Bio. 6), but the results obtained were very different from all the others. The variety grown was BH. 10 (12) and the absolute quantities of nitrogen and phosphate in the leaves were normal and practically the same as in Bio. 5, these two trials being adjacent. The percentage of potash was, however, abnormally high, averaging to about 2% of the dry weight of the leaf compared to about 1.2% in the case of Bio. 5. As a result, the relative proportions of the three plant nutrients deviate greatly from the optimum provisionally adopted. It may be that this high K O intake is connected with the wide spacing adopted in this trial, three stools occupying an area of 120 square feet instead of the normal 37.5 square feet. For this reason the results are not given in detail.

In two of the trials discussed above, samples of leaves from canes of different morphological ages were taken, i.e. from shoots with three to four feet of cane and from comparatively young shoots not yet showing any cane to determine the variation which might be caused by this factor. In so far as the nitrogen and phosphate content of the leaves is concerned the results from the two sets of leaves agree fairly closely. One of the trials sampled for these experiments was trial Bio. 6 in which anomalous results for the potash content were obtained. In this trial the potash content of the small shoots (babas) was higher than that in the more mature shoots by about 0.3%, but in trial 69, the figures were about the same.

Further research work in this connection planned for 1938 is as follows :

- (a) Analysis of samples taken at regular intervals, to determine the effect of age and season.
- (b) Analysis of samples from areas of high fertility, when high yields are obtained, to try to determine the optimum ratio between the plant nutrients.
- (c) Analysis of samples from areas of low fertility.
- (d) Analysis of the leaves from the new Mauritius varieties growing in variety trials under similar conditions to determine the effect of variety.

This method of foliar diagnosis is, up to the present, very promising, and it is hoped as a result of further experiments to elaborate a method which will enable the fertiliser programme to be so drawn up, as to give the best balance between the various plant food elements ; in addition this method would enable the uptake of the various elements by the plant to be followed, so that deficiencies might be remedied later.

BOX EXPERIMENTS WITH PHOSPHATE FERTILISERS

Two box experiments to investigate the best method for application of phosphatic fertilisers were conducted during the year, but unfortunately in each case the maize plants were so badly attacked by borers that it was considered that no reliable data would be obtained by weighing the plants.

The different methods of application tested against a control treatment which received no phosphatic fertilisers were as follows:—

- (a) Phosphate mixed with all the soil;
- (b) Phosphate placed in a layer 3 inches deep;
- (c) Phosphate placed in pockets at a depth of 3 inches;
- (d) Phosphate applied as a top dressing.

In the early stages of growth treatment B was, judging from visual observation, by far the most effective, the plants growing more rapidly, and looking much healthier than in the other treatments. Little difference was noticed between the no-phosphate boxes and those in which the phosphate was applied to the surface. Some improvement was seen in treatments (a) and (c) which were, however, definitely inferior to treatment (b). Later there was a decided improvement in treatments (a), (c) and (d), but when the heavy borer infestation occurred, (b) was still the best, the no-phosphate plots always being the worst.

These observations were recorded in both experiments, and further experiments of this nature are being started.

WORK BY ESTATE CHEMISTS

Mr. G. Ducray, Chemist of Queen Victoria S. E. continued the examination of soils from this estate and from Constance S. E. with a view to determining their plant food requirements.

Mr. O. d'Hotman de Villiers of Highlands S. E., worked on the problem of the solubility of the various constituents of powdered basalt by means of repeated extractions with dilute nitric acid. As a result of these experiments he has started some large scale experiments in the upper part of this estate with a view to "rejuvenating" these old soils of the high rainfall regions, which are highly laterised, by means of applications of powdered basalt, the application varying from about 5 tons per arpent up to 100 tons per arpent.

MANURIAL EXPERIMENTS

A short account of the manurial trials reaped during the year is given in the following pages. At times difficulties were encountered on account of shortage of labour, but finally all the work was performed satisfactorily. Provision has been made in all these trials for the elimination of border effect.

Trial 69, Central Experiment Station, Reduit.—This trial consists of two series of plots, series A receiving a somewhat low dressing of complete fertiliser, whereas series B received exactly four times as much. This field of M.27/16 was in second ratoon canes which were reaped at an age of 12 months. The results obtained were as follows.—

Treatment	Yield of cane in tons per arpent
A. Small dressing of complete fertiliser	15.8 tons
B. Heavy " "	27.1 "

These results show that the heavy application is continuing to give big increases over the small application, on this field of low fertility. In all three crops so far, treatment B has yielded 44.3 tons of cane per arpent more than treatment A.

This trial was laid down to investigate border effect; in this year there was no significant difference between the differently situated rows in the B plots, but the two outside rows of the A plots gave approximately 15% more cane than the centre four rows.

TRIAL 70.

This trial, conducted at Bel Air-St. Félix S.E., with the variety BH. 10 (12), on a randomised block layout, was reaped in 2nd ratoons at the age of 13 months, with the following results:

CALCULATED RESULTS OF TRIAL No. 70.

Series	Treatment	Yield in tons per arpent	
		1st ratoons reaped in 1936	2nd ratoons reaped in 1937
1	Nil 	31.0	27.8
2	{ 150 kgs superphosphate 100 kgs sulphate of potash 150 kgs sulphate of ammonia }	36.3	34.4
3	{ 150 kgs superphosphate 100 kgs sulphate of potash }	35.3	28.5
4	{ 150 kgs superphosphate 150 kgs sulphate of ammonia }	33.3	33.4
5	{ 100 kgs sulphate of potash 150 kgs sulphate of ammonia }	35.0	32.2
6	{ Same as (2) but this series received fumier in the virgin crop ... Significant difference ... }	37.3 4.6	36.5 4.2

The results with first ratoons reaped in 1936 are given as they were not given in full in the 1936 annual report.

In the 2nd ratoon crop, it is seen that where artificial nitrogenous fertilisers have been omitted from the fertiliser programme then a significant reduction in yield has occurred. It would appear also that phosphate has had some effect, but the difference is not sufficient to be significant. The elimination of potash from the mixture has had very little effect upon yield.

Trial 72.—This trial was conducted at Beau Bois, St. Aubin S.E., on a randomised block layout with the variety B.H. 10 (12). The 2nd ratoon crop was cut at the age of 12½ months.

Series	Treatment	Yield of cane in tons per arpent	
		In 1st ratoons 1936	In 2nd ratoons 1937
1	No fertilisers ...	29.3	28.0
2	{ 60 kgs sulphate of ammonia 40 kgs nitrate of soda 100 kgs phosphatic guano (estate practice)	35.7	31.0
3	{ 150 kgs phosphatic guano 75 kgs sulphate of potash 75 kgs sulphate of ammonia 50 kgs nitrate of soda	34.8	32.2
4	{ 150 kgs phosphatic guano 75 kgs sulphate of potash 75 kgs sulphate of potash	30.7	31.5
5	{ 75 kgs sulphate of ammonia 50 kgs nitrate of soda	31.2	30.1
6	{ 150 kgs phosphatic guano 75 kgs sulphate of ammonia 50 kgs nitrate of soda	34.3	32.2
	(Significant difference ...)	3.9	3.2

In both ratoon crops, there has been a significant difference in yield between the no fertiliser plot and the complete fertiliser plots. This increased yield is due chiefly to nitrogen and phosphates in approximately equal amounts and potash does not seem to have had much influence on yield. In the virgin crop of this trial, there was no response to phosphatic or potassic fertilisers, but a highly significant increase followed the application of nitrogenous fertilisers.

Trial 92.—This trial, designed to test the effect of equivalent quantities of a mixture of straight fertilisers and complete concentrated fertilisers, and also to test the effect of applying pen manure in one or two applications to virgin canes was conducted at St. André S.E. on a randomised block layout. This trial was carried out under irrigated conditions.

CALCULATED RESULTS OF TRIAL 92

Series	Treatment	Yield in tons per arpent
1	{ 100 kgs phosphatic guano 50 kgs sulphate of ammonia 50 kgs nitrate of potash 50 kgs nitrate of soda (manure applied in one application to virgin crop)	44.6
2	Same as (1) ... (manure applied in two applications to virgin crop)	44.0
3	{ 200 kgs phosphatic guano 100 kgs sulphate of ammonia 50 kgs nitrate of potash	42.9
4	{ 100 kgs nicifos 50 kgs nitrate of potash	42.4
	(Significant difference ...)	3.8 tons of cane per arpent

In the virgin crop, treatments 3 and 4 gave roughly 2 or 3 tons of cane more than did treatments 1 and 2. In this crop, however, the position is reversed, the first two beating the last two slightly. No differences are significant.

Trial Bio. 5.—This trial was qualitative in character and was designed to test the effect of phosphatic and potassic fertilisers at the Central Experiment Station at Réduit. It was conducted on a randomised block layout with the cane variety BH. 10 (12). The whole trial received a basal dressing of 3 tons pen manure per arpent. No irrigation was practised.

CALCULATED RESULTS OF TRIAL BIO. 5

Series	Treatment	Yield of cane in tons per arpent
1	{ 200 kgs phosphatic guano 200 kgs superphosphate 300 kgs sulphate of ammonia 200 kgs sulphate of potash 50 kgs nitrate of soda	51.0
2	{ 200 kgs phosphatic guano 200 kgs superphosphate 300 kgs sulphate of ammonia 50 kgs nitrate of soda	44.7
3	{ 300 kgs sulphate of ammonia 200 kgs sulphate of potash 50 kgs nitrate of soda	42.7
	Significant difference ...	5.6 tons of cane per arpent

The omission of phosphatic fertilisers has resulted in a decrease of yield amounting to 8.3 tons per arpent, and of potash in a decrease of 6.3 tons of cane per arpent, both these differences being significant. Again, where potash was omitted it would appear that the sucrose content of the canes was also reduced by about 0.5% sucrose in the cane.

Trial Bio 6.—In the Sixth Annual Report of the Sugarcane Research Station for the year 1935, short descriptions were given of box experiments with subsoils. The results obtained in these were so important as to warrant the carrying out of a small scale field experiment with sugarcane as the indicator crop. Consequently a small plot of land was chosen at the Central Experiment Station at Réduit, and it was divided into five blocks each of eight plots, 12 feet x 10 feet in size. In each block, two plots contained the normal soil, three plots had the top soil mixed with subsoil in the ratio of 3 to 1, whilst, in the other 3 plots all the surface soil was removed and subsoil from the borders of the experimental area was put in its place. The treatments described in the following table were given and three stools of the sugar cane variety BH. 10 (12) were planted near the centre of each plot. The planting was carried out on March 14th, 1936 and the canes were reaped on August 2nd, 1937, at an age of 16½ months. The results are given in the following table.

CALCULATED RESULTS OF TRIAL BIO. 6

Series	Medium	Treatment	Yield in kgs. of sugar cane per plot
1	Soil only	... Same as series 3 in Trial Bio. 5 (i.e. no phosphate) ...	67.5
2	Soil only	... Same as series 1 in Trial Bio. 5 (i.e. complete) ...	81
3	Soil subsoil	... Same as series 3 in Trial Bio. 5 (i.e. no phosphate) ...	59
4	Soil subsoil	... Same as series 3 above + 1 kg of phosphatic guano mixed with soil ...	72
5	Soil subsoil	... Same as series 4 above + 20 kgs pen manure mixed with soil ...	77
6	Subsoil	... Same as series 3 in Trial Bio. 5 (no phosphate) ...	38
7	Subsoil	... Same as series 6 above + 5 kgs phosphatic guano mixed with soil ...	63
8	Subsoil	... Same as series 7 above + 100 kgs pen manure mixed with soil ...	75
		Significant difference between two series	23

The significant difference is high because of the smallness of the plots but in spite of this, the addition of phosphatic guano to the subsoil has resulted in a significant increase.

In every case the addition of phosphatic guano has shown an increased yield, and pen manure in both cases has also resulted in an increased yield. It is interesting to note that these results confirm in all respects those obtained from the box experiment in which maize was the indicator crop.

It would appear, therefore, that the chief reason for the infertility of Mauritius subsoils may be caused by the lack of available phosphates, and in cases where the yielding power of soils has been affected by admixture of subsoil due to too deep ploughing, etc., then heavy applications of phosphatic fertilisers may restore the soil to its original fertility.

Trial Bio. 7.—This trial situated at Queen Victoria S. E. was designed to test equivalent quantities of a complete fertiliser made up of straight fertilisers and a complete concentrated fertiliser. In the virgin crop the mixture of the straight fertilisers gave 3 tons of cane more per arpent than did the C.C.F. whereas in the 1st ratoon crop the C.C.F. gave an increase of just one ton of cane per arpent.

Trial Bio. 8.—This trial conducted at Bel Ombre S. E., was designed to test the relative efficiency of different forms of phosphatic fertiliser, the different forms being phosphatic guano, precipitated phosphate and nicifos, a control series of plots receiving no phosphatic fertilisers. All the plots received the same amount of nitrogen and potash per arpent, whilst all the plots receiving phosphates had the same quantity of P_2O_5 applied. The canes—variety B.H. 10 (12)—were reaped in the virgin crop at the age of 17 months, and no significant differences were found. It may be assumed, therefore, that this soil contained sufficient available P_2O_5 for efficient cane growth, and consequently the relative efficiency of the different forms of phosphatic fertiliser could not be determined.

Trial 71.—The trial conducted at Benarès S.E., with BH. 10 (12) on a randomised block layout, was reaped in 2nd ratoons at the age of 12½ months, with the following results:—

CALCULATED RESULTS OF TRIAL 71

Series	Treatment	Yield in tons per arpent	
		1st ratoons reaped in 1936	2nd ratoons reaped in 1937
1	Nil	32.1	32.4
2	{ 75 kgs phosphatic guano 30 kgs nitrate of potash 37.5 kgs nitrate of soda }	33.6	32.9
3	{ 50 kgs nitrate of soda 50 kgs sulphate of ammonia }	34.7	32.3
4	200 kgs superphosphate	32.0	33.4
5	75 kgs sulphate of potash	33.8	30.9
6	{ 50 kgs nitrate of soda 50 kgs sulphate of ammonia 200 kgs superphosphate }	35.7	34.2
7	{ 50 kgs nitrate of soda 50 kgs sulphate of ammonia 75 kgs sulphate of potash }	34.6	33.2
8	{ 200 kgs superphosphate 75 kgs sulphate of potash }	32.9	30.5
9	{ 50 kgs nitrate of soda 50 kgs sulphate of ammonia 200 kgs superphosphate 75 kgs sulphate of potash }	35.6	33.1
	Significant difference	2.5	4.1

Conclusions.—In second ratoons none of the differences were sufficiently great to be considered significant, and therefore it must be concluded that the land when the experiment was started was in a high state of fertility.

N. CRAIG,
Senior Chemist.

Réduit,
January, 1938.

PART III—RESEARCH BOTANY

ROOT INVESTIGATIONS

In the last annual report a new method of determining the absorbing surface of sugarcane root-systems was described, together with some preliminary data on the absorbing surface of three varieties on one soil type.

The results obtained indicated that absorbing surface of the root-system was a character of great importance in a cane variety, and offered a more promising approach to the correlation of root activity with other factors in cane growth than that provided by previous root studies. This work was greatly extended during the year, two important lines of research being completed, and new ones initiated. The results of the former will be briefly described here, under the titles of (1) The development of the root-system of three varieties on different soil types and (2) an investigation of the absorbing surface of several varieties in first ratoons.

1.—INVESTIGATIONS ON THE ROOT DEVELOPMENT OF THREE VARIETIES OF SUGARCANE ON SEVERAL SOIL TYPES

The three varieties used in this investigation were POJ. 2878, BH. 10 (12) and White Tanna; they were planted in four 3x3 latin squares on each of the following soil types:—

- I. Badly drained grey soil. Locality St André S.E.
- II. Low degree of laterisation, immature. Locality Pierrefonds S.E.
- III. High degree of laterisation, immature. Locality Reunion S. E.
- IV. Low degree of laterisation, mature. Locality Richelieu S.E.
- V. High degree of laterisation, mature. Locality Hermitage (Highlands S.E.)

The root-systems were examined (a) by the block method for root distribution—the root systems being subsequently reconstructed, and (b) by the new method for the determination of total absorbing surface. Qualitative and quantitative data on root development were thus obtained, examinations being carried out when the plants were 3, 6, 10 and 15 months old.

A complete record of root distribution at the various localities in the form of photographs of the reconstructed systems together with detailed quantitative data on root hair density and total absorbing surface, and on shoot length and total leaf area of the stools for the three varieties at the various times of examination are thus available.

Influence of environment on root distribution.—The distribution of roots in the different localities was markedly affected by soil moisture, temperature and oxygen supply, in addition to other features of the environment such as soil texture, chemical composition, nutrient status and various other less important factors. In Mauritius several of these factors are closely associated with the soil type, so that, in a general way, it is the sum total of the environmental conditions that effect root growth and distribution. Nevertheless, it was possible, in several instances to detect certain effects as being due to soil moisture or aeration, and other effects as being more likely due to the nature of the soil. In this connection, it is considered, that in Mauritius, soil moisture appears to have a preponderating effect on root distribution.

Even at the age of three months, the distribution of roots was closely associated with the moisture conditions of the environment. In general, superficial roots were located at a much greater depth in the dry environments than in the wet localities, whereas the buttress roots passed more or less vertically downwards in all environments. In particular, all the roots penetrated downwards in the dry environments of Richelieu and Pierrefonds, whereas there was a marked lateral distribution in the moist localities of Reunion, Hermitage and St. André. There was a marked deficiency of roots in the first six inches of soil at St. André where the moisture supply was underground, but as soon as the rainy season commenced, and the upper 6" of soil subsequently moistened, root activity was prolific in this layer also.

At the age of six months the differences between root development in the different environments were still more marked.

At St. André, no roots penetrated the impervious clay layer located at 2-2½ feet to any considerable extent. It is considered that lack of aeration in the water-logged clay layer was responsible for this restriction of root growth. Nevertheless, the plentiful supply of underground drainage water in the friable yellowish subsoil, and the richness of this water in leachings from other parts, together with the basic fertility of this soil type enabled the varieties to make excellent growth. The deficient soil moisture at Pierrefonds resulted in almost vertical root penetration, there being practically no lateral system at 6 months of age. The high soil moisture at Réunion and Hermitage, on the other hand, resulted in a markedly superficial development of roots, and particularly was this so, at Hermitage. The presence of lateral roots up to the very surface of the soil in the latter environment appeared to indicate a deficiency of aeration, caused by the high rainfall, since at Réunion, although the development was markedly superficial, roots did not curve upwards to the soil surface as at Hermitage. It is probable also that the Réunion environment was better drained. The advent of the summer rains, prior to the third examination caused renewed superficial root growth in all the environments. There was thus a very marked change in root distribution in such environments as Pierrefonds, where previously there was no superficial system, a well formed surface system followed the availability of moisture in the surface soil.

The general scheme of root distribution showed no marked change between the third and fourth examinations (i.e. between 10 and 15 months of age). The extreme importance of soil moisture in determining root distribution as found by other investigators was thus amply confirmed.

Influence of variety on root distribution.—Notwithstanding the fact that the distribution of the root system was markedly affected by the environmental conditions, and, in particular, the moisture content of the soil, there were still some varietal differences still apparent under the varied conditions. The development of the superficial system was, for example, generally weaker in POJ. 2873 than in the other two varieties and consisted of short, thin, much-branched roots, together with long thick roots branched only towards their terminations. In the superficial systems of BH. 10 (12) and White Tanna, the roots were more uniform, though at a late stage in all varieties superficial primordia germinated to give rise to short roots bearing any fibrous branches. The buttress system was, on the other hand, proportionately much stronger in POJ. 2878 than in the other varieties, irrespective of environment.

When soil moisture was abundant, BH. 10 (12) had a very shallow superficial system whereas the deeper roots passed downwards almost vertically below the stool. In White Tanna, the superficial system was not so shallow and the deeper roots not so vertically penetrating, with the result that the system as a whole approximated more closely to the "inverted fan" formation described by several investigators as representing the distribution of a sugar cane root system.

Variety and Root development.—There is little doubt that the varieties differed markedly in the rate of root development and in the time for which roots function. White Tanna had thus the greatest mass of roots during most of the growth cycle. In the 15 month old canes the root-system of White Tanna appeared to be the least viable as judged by the dark colouring of the roots, and the presence of roots with shrivelled cortical tissues. There is also little doubt that POJ. 2878 as judged by the lighter colour of the roots and fewer roots having sloughed off cortex, was in the most viable state at this time. BH. 10 (12) was intermediate between the two varieties mentioned. This result was not due to the presence of late tillers in POJ. 2878 and the absence of such tillers in the other two varieties investigated. Contrariwise, late tillers were present to about an equal degree in the three varieties.

From 6—10 months, the rate of tillering had been higher in POJ. 2878 and BH. 10 (12) than in White Tanna, but between 10 and 15 months there was no significant difference between the three varieties.

Barbados workers have classified canes according to the periodicity in aerial development. Stevenson (1936) claims that root development follows the same scheme. This result has not been confirmed in the present investigations. Thus POJ 2878, under Barbados conditions was found to have a short-lived root system in accordance with its early maturing character wherein the period of vegetative growth in the individual canes is very short. Although its vegetative features in Mauritius conforms to this type—the root system has been found to be the most long-lived of the three varieties investigated, in this and in other investigations, it having the most viable root-system at 15 months of age.

White Tanna, on the other hand, which on the Barbados classification, would be a long season cane, has an early formed short-lived root-system in Mauritius. The data indicate that there appears to be no simple relationship between aerial growth and root-development applicable to all varieties. It appears that the $\frac{\text{Shoot}}{\text{Root}}$ ratio is fundamentally different in the different varieties (high in POJ. 2878, low in White Tanna and BH. 10 (12)), and that independently of aerial growth the capacity for root development differs in different varieties.

Fibrous root production ; effect of variety and environment.—Fibrous root production is considered to be best expressed as the fibrous root ratio, which is the length of fibrous roots borne per unit length of all other roots (Groups II to IV combined). The values of the fibrous root ratio were markedly dependent upon environment, age and variety. The ratio was negatively correlated with the moisture content of the environment being highest in the dry environment of Pierrefonds and lowest in the wet environments of Réunion and Hermitage. It appears that the fibrous root ratio provides a reliable diagnosis of the degree of wetness of the soil wherein the canes are grown.

The ratio was low in young plants, increased to a maximum value at the age of 10 months and decreased again between 10 and 15 months. Fibrous root production thus followed the well-known S—curve of plant growth, but like aerial growth was markedly affected by environmental conditions. In the three varieties used in this investigation the highest rate of fibrous root production was between 3 and 6 months of age, though the rate of increase was still high between 6 and 10 months. It is possible that the low rainfall between 3 and 6 months was the cause of the maximum rate of increase being located in the period 3 to 6 months.

The fibrous root ratio was, on the whole, highest in POJ. 2878, BH. 10 (12) being second and White Tanna last. In the last examination, however, White Tanna was slightly superior to BH. 10 (12). The curves of fibrous root production indicated that fibrous roots may be formed somewhat earlier in BH. 10 (12) than in the other two varieties. This is demonstrated by the fact that in BH. 10 (12), 63.3% of the maximum fibrous root production was present at 6 months, whereas in White Tanna the percentage was 54.3, and in POJ. 2878, 52.0.

This differential behaviour may indicate a greater adaptability of BH. 10 (12) to the dry conditions that existed in the period 3–6 months. The earlier formation of fibrous roots in BH. 10 (12) is further indicated by the fact that in the 15 month old root systems it was the poorest in this respect, whereas POJ. 2878 which showed the slowest *comparative value* of fibrous root production had the highest fibrous root ratio of the three varieties at 15 months.

Root hair density.—The root hair density also was affected by variety environment, and age of plants. The root hair density, on the whole, was higher at all times in POJ. 2878 than in the other two varieties; this being always so in the case of the fibrous roots and for most of the life cycle in the case of the thicker roots. The importance of this fact is further magnified when it is considered that the fibrous root ratio is also generally higher in this variety. There was comparatively little difference in the root-hair density between BH. 10 (12) and White Tanna under the conditions obtaining. The difference in the root hair counts found in this investigation appear to be varietal differences which are not associated with differences in the periodicity of growth, since they are in the same direction during the whole life history of the plants.

The root hair density was considerably higher in all the dry environments than in the wet localities, differences due to environments being considerably greater than those due to variety. At 15 months (*i.e.* at the close of the long wet season) when the root-systems were becoming more or less moribund, the differences in root hair counts between the different environments had become insignificant. Root-hair density was markedly affected by the age of the plants, reaching its maximum at 6 months. The lowest density of root hairs occurred in the 15 month old plants.

It is possible that the maximum density of root hairs at 6 months was conditioned by the low rainfall of the period 3 to 6 months.

Length of roots.—The data on root length once more showed clearly that the total length of roots cannot, of necessity, be taken as an index of the absorbing surface. The total length reached its maximum earliest in the hot environments of St. André and Pierre fonds, the loss of fibrous roots causing a marked drop in the total root length during the period 10—15 months. At Réunion and Hermitage, however, there is, in general, an increase in the length of roots up to 15 months. The age of 12—14 months, which was previously selected for the survey of sugarcane root systems in Mauritius (Evans 1935) was thus well chosen, since at this time an approximation to the maximum root development is obtained.

The Absorbing Surface of the Root Systems.—At St. André, White Tanna had the most extensive absorbing surface up to the age of six months subsequently, it had the smallest absorbing surface, POJ. 2878 being on the whole the best in this respect, and BH. 10(12) a close second. There was a marked drop in the absorbing surface between 10 and 15 months, this drop being greatest in White Tanna, indicating the early maturity of the root system of this variety, and thus confirming the results obtained in a previous investigation at Reduit.

At Pierrefonds, BH. 10 (12) and White Tanna were superior to POJ. 2878 up to 10 months, but at 15 months there was no difference between the three varieties. The drop in the absorbing surface which occurred between 10 and 15 months was here again much greater in White Tanna than in the other varieties.

At Réunion, the development of the absorbing surface was about equal in the three varieties up to 10 months. Between 10 months and 15 months the absorbing surface of BH. 10 (12) and White Tanna was just maintained whereas there was a considerable increase in POJ. 2878 during this period, the latter variety having a considerably more extensive absorbing surface at 15 months.

At Hermitage, White Tanna maintained a higher absorbing surface throughout the whole period. This variety and POJ. 2878 showed an increase between 10 and 15 months whereas BH. 10 (12) showed a decrease during this period. Thus, in general, the absorbing surface increases to a maximum at ten months of age in the hot environments, thereafter there is a sudden and marked drop in the absorbing surface. The maximum is reached at a later date in the cold environments, and appears to be approximately 15 months under the conditions obtaining. Comparison of different environments indicate that both heat and moisture have a marked effect in accelerating root development, the effect of temperature being considerably greater than that of moisture. The existence of a marked drop in the absorbing surface of plant canes at 10–15 months (the actual time being dependent mainly on the temperature and moisture conditions of the environment), is undoubtedly of great importance in determining the ratooning capabilities of varieties. A root-system which has become moribund, with a very low absorbing surface, cannot possibly give rise to a vigorous ratoon crop, whereas a root system that has an extensive absorbing surface at the time the canes are harvested, is able to supply the young ratoon shoots with water and salts until their own root system is established. In this respect, POJ. 2878 appears to be greatly superior to BH. 10 (12) and White Tanna. There is undoubtedly a differential

response of varieties in this respect, as is seen by a comparison of BH. 10 (12) and White Tanna at St. André and Hermitage respectively. In the former environment the absorbing surface of White Tanna dropped to a much larger extent between 10 and 15 months than that of BH. 10 (12), whereas in the cold, wet environment of Hermitage the converse was the case. This may explain the comparatively poor performance of BH. 10 (12) in the cold wetter districts, and the superiority of White Tanna under such conditions, whereas in the hot, drier districts BH. 10 (12) yields well.

The Transpiring Surface
Absorbing Surface ratio.—It is considered that the ratio between the leaf surface and the root hair surface is of considerable importance in the water economy of the plant. The leaf area was, therefore, measured when the root examination was carried out. The values of the ratio obtained, indicate a most favourable position from the point of view of water economy at the age of six months. In the hot environments of St. André and Pierrefonds (as would be expected from the fall in the absorbing surface) there is a marked increase in the ratio between 10 and 15 months, indicating that, at the latter period the canes would be ill fitted to withstand a drought.

In general the ratio is considerably lower in the dry environments than in the wet localities, indicating a definite adaptation of the cane plant to the environment in which it grows.

As young canes, BH. 10 (12) has the most favourable ratio, POJ. 2878 being second and White Tanna last. As mature canes, however, POJ. 2878 has the most favourable ratio. This may indicate a greater drought resistance in BH. 10 (12) as young cane, but in POJ. 2878 as mature cane. Over the whole period of growth the average ratio in the three varieties were as follows:—POJ. 2878, 10.5; BH. 10 (12), 11.1; White Tanna, 13.5. There is little doubt that such a differential behaviour in the capacity for drought resistance at different ages exists.

Cane Growth.—The growth of the stool was followed in terms of the total length of cane. The best growth occurred at St. André; growth was almost exactly equal at Pierrefonds and Hermitage, whereas at Réunion it was markedly subnormal. Analysis of the soils* showed that the extreme poverty of the Réunion soil in phosphates and potash was the probable cause of the poor growth in that environment. A comparison of cane growth with the values of the absorbing surface showed some important effects of the environment on the production of cane. The production of an equal amount of cane at Hermitage and Pierrefonds necessitated the formation of a much greater absorbing surface in the latter environment. The large absorbing surface at Pierrefonds in turn was associated with the formation of two-thirds as much cane as the small absorbing surface at St. André where subsoil water was available.

Under favourable conditions of moisture and nutrients, the results indicate greater powers of cane production per unit absorbing surface by POJ. 2878, but where the conditions are unfavourable, White Tanna appears to be superior.

* Analysis of soil samples from the different environments were kindly undertaken by Mr. P. Halais.

Summary.—It has been shown that the distribution of roots and the development of the absorbing surface is markedly affected by environmental conditions. Sugarcane like most other plants, has a remarkable capacity for adapting itself to the environment in which it grows. These powers of adaptation complicate tremendously the relations involved. No such close relationship between root development and the development of the above ground parts as that postulated by Stevenson (1936) has been established. In fact it is only necessary to compare the cane growth at Hermitage and Pierrefonds (which was almost identical) with the development of the absorbing surface in these localities (which was vastly dissimilar) to realise that no such simple relationship is indicated.

The detailed account of the work described above has been prepared for publication.

II.—INVESTIGATIONS OF THE ABSORBING SURFACE OF SEVERAL VARIETIES OF SUGAR CANE IN FIRST RATOONS.

In this investigation which has also been completed and prepared for publication, the following varieties were used : POJ. 2727, POJ. 2878, SC. 12/4, BH. 10 (12), M. 196/31, M. 106/30 and Selangor Seedling. The examinations were carried out at 3-4 months, 8-9 months and 12 months after the harvesting of the plant canes.

Root mass.—The two varieties M. 196/31 and M. 106/30 (parentage POJ. 2878 x Uba Marot) had the greatest root mass, thus confirming once more the results of previous qualitative examinations of the root system of this class of seedlings. SC. 12/4 and BH. 10 (12) had a similar and high mass of roots, whereas the Java varieties POJ. 2878, POJ. 2727 and Selangor Seedling had a lower root mass than any of the other varieties. With regard to the formation of fibrous rootlets the rate was surprisingly constant, with the exception of M. 196/31 between the first and second examinations (i.e. in the wet growing season). In the period between the second and third examinations there was a remarkable increase in fibrous root production in M. 196/31 and POJ. 2727.

In POJ. 2878 and BH. 10 (12) there was a fall in the total length of fibrous roots during this period, this being in both cases due to a fall in the fibrous root ratio. This ratio, in all the varieties shows a marked correlation at different times with the moisture conditions prevailing in the period prior to the examination, showing a fall between the first and second examinations with the advent of the summer rains, the ratio being higher both before and after this period, with the exception of the fall in the after-period in BH. 10 (12) and POJ. 2878, mentioned above.

Root-hair density.—There was a continuous fall in the density of root hairs throughout the period of the investigation. Nevertheless, there was a decided maintenance of their relative position with regard to root hair density in the different varieties at the different times of examination. This is shown in the following table (the figures relating to each variety being a summation of their position with regard to each class of root.)

TABLE SHOWING RELATIVE POSITION OF THE VARIETIES WITH RESPECT
TO ROOT HAIR DENSITY AT THE VARIOUS EXAMINATIONS.

	1st Examination			2nd Examination			3rd Examination.		
Best.	Selangor			Selangor					
	Seedling	(5)	...	Seedling	(6)	...	SC. 12/4	(5)	
	SC. 12/4	(8)	...	SC. 12/4	(10)	...	Selangor		
							Seedling	(8)	
	POJ. 2878	(16)	...	M. 106/30	(13)	...	POJ. 2878	(15)	
	M. 106/30	(17)	...	BH. 10 (12)	(14)	...	B.H 10 (12)	(16)	
	BH. 10 (12)	(19)	...	POJ. 2727	(21)	...	M. 106/30	(16)	
	M. 196/31	(12)	...	M. 196/31	(23)	...	M. 196/31	(26)	
Worst.	POJ. 2727	(26)	...	POJ. 2878	(26)	...	POJ. 2727	(26)	

It is considered that this result is of great importance in that it implies that root-hair density is a varietal feature, which is not to any appreciable extent occasioned by a periodicity in the growth cycle such as that postulated by Mackintosh and Stevenson (1935). It is obvious that had root-hair density been affected by differences in growth periodicity varieties which headed the list at one stage would be found at the bottom of the list at a later stage.

Correlation between Virgin and Ratoon Root systems.—A correlation coefficient was worked out between the mass of the virgin root system and the mass of the ratoon roots. The value obtained (+0.75) showed that there was a close relation between the root mass formed by these varieties as plant canes and as first ratoons.

Root-hair surface.—There was, in general, a considerable drop in the absorbing surface between the second and third examinations confirming the result obtained in the study of the root-system of plant canes on various soil types where there was also a fall in the absorbing surface as the plants approached maturity. The drop was very small in SC. 12/4 and there was actually a slight increase in POJ. 2878. This again supports the previous findings on the root-system of the latter variety, wherein it was shown that the absorbing surface of POJ. 2878 does not deteriorate as rapidly when approaching maturity as that of several other varieties. The extremely efficient absorbing surface possessed by SC. 12/4 at the beginning of the season was maintained throughout the growing period. M. 106/30, in virtue of its high root mass also maintained a favourable position throughout the period of the investigation. Selangor Seedling, which had the best absorbing surface at the second examination fell to fourth place at the last examination.

Osmotic pressure of the root fluids.—A determination of the osmotic pressure of newly formed roots by the cryoscopic method failed to show a significant difference between the varieties in this respect, indicating that there was possibly no difference in the efficiency of the absorbing surface in the different varieties.

Leaf Area.—There were interesting features in the leaf relationship of the different varieties. Five varieties flowered profusely, and these showed a maximum leaf surface at the second examination. In the two varieties which did not flower (SC. 12/4 and BH. 10/12), on the other hand, the leaf surface continued to increase after the second examination.

The $\frac{\text{Transpiring Surface}}{\text{Absorbing Surface}}$ Ratio.—The variety SC. 12/4 was outstanding amongst the seven varieties investigated in having, throughout the growth cycle a low value of the $\frac{\text{transpiring surface}}{\text{absorbing surface}}$ ratio. Selangor Seedling had also a low ratio, BH. 10 (12) running it very close in this respect. POJ. 2878 and M. 106/30 had very favourable ratios as mature stools. POJ. 2727 and M. 196/31 had throughout high ratios. If, as seems reasonable, the value of this ratio has any relationship with drought resistance SC. 12/4, Selangor Seedling and BH. 10 (12) in the order named appear to be outstanding as drought resisting canes. In this connection, however, the results must be interpreted with caution. It is known, for example, that POJ. 2727, which according to the value of the ratio determined in this investigation should not be drought resisting, does, in fact, appear to give good yields in the drier parts of Mauritius. In this investigation it also gave a high yield in spite of its consistently low absorbing surface. An examination of the data suggests, however, that its high yield has resulted from a high growth rate in the period between the first and second examinations, i.e. in the wet season. During this period, the absorbing surface would not be expected to limit growth. Even in the dry parts of Mauritius, soil moisture is generally not limiting over a considerable part of the growing season, so that a variety like POJ. 2727 having the capacity for rapid growth when moisture is available, would produce a good yield. It, therefore, appears that a high yield produced in such a locality might not, of necessity, indicate a high drought resistance.

In the present investigation there was no correlation whatsoever between the yield of cane produced in the different varieties and any features of their root system, such as root length, mass, fibrous root production or absorbing surface. The relationship between root mass and cane production which has been demonstrated for plants of any one variety growing under similar conditions does not appear to hold when plants of different varieties are considered

Other root investigations.—New root plots have been laid down in which all the recently produced commercial seedlings of value have been included, with a view to determining their type of growth, the nature of their root system and the development of the absorbing surface. The varieties included in this investigation are M. 72/31, M. 73/31, M. 171/30, M. 108/30, M. 140/31, M. 134/32, M. 167/32, M. 168/32, M. 2716 and B.H. 10/12 as a Standard for Comparison.

STATISTICAL INVESTIGATIONS ON THE ERROR OF VARIOUS KINDS OF PLOTS USED IN FIELD EXPERIMENTATION WITH SUGARCANE

A partial analysis of the results of a large scale uniformity trial carried out at St. Aubin S.E. in 1934 has been completed. This trial consisted of 142 lines each 100 holes long, harvested in plots of 20 holes. It has thus

been possible to determine the error of plots 20, 40, 60, 80 and 100 holes long with widths varying from one to ten lines. The values of the standard errors calculated for the various kinds of plots are given in the following table, as a percentage of the mean plot yields.

No of rows wide :	No. of holes long	20	40	60	80	100
	1	15.34	10.31	7.30	7.28	8.04
	2	10.71	6.54	5.03	4.02	4.19
	3	9.47	6.08	5.28	4.48	4.43
	4	8.86	6.86	5.93	4.87	5.17
	5	8.33	6.16	5.05	3.82	4.68
	6	7.73	6.95	5.62	5.52	5.54
	7	8.11	6.12	4.96	4.58	4.89
	8	8.58	6.72	5.82	5.26	5.13
	9	7.22	6.12	5.55	4.61	4.25
	10	7.04	6.74	6.30	5.65	5.21

The effect of increasing the width of the plot in the case of various standard lengths are shown in Figs. 1 to 5, and will be discussed briefly here.

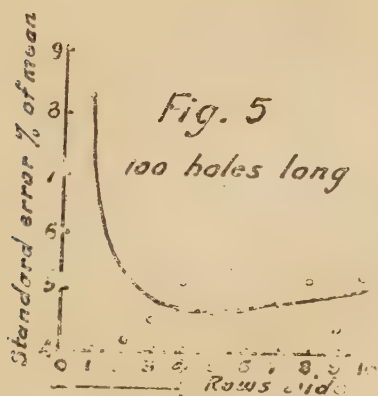
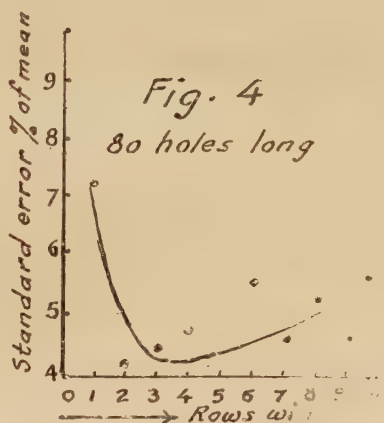
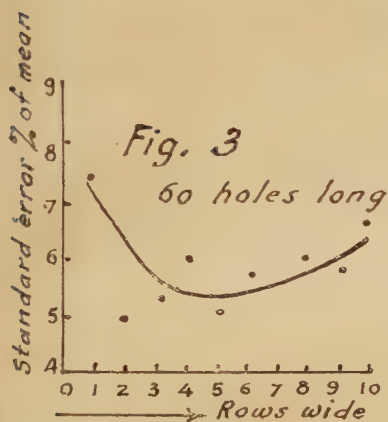
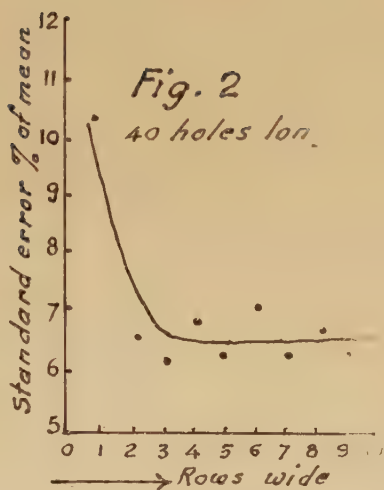
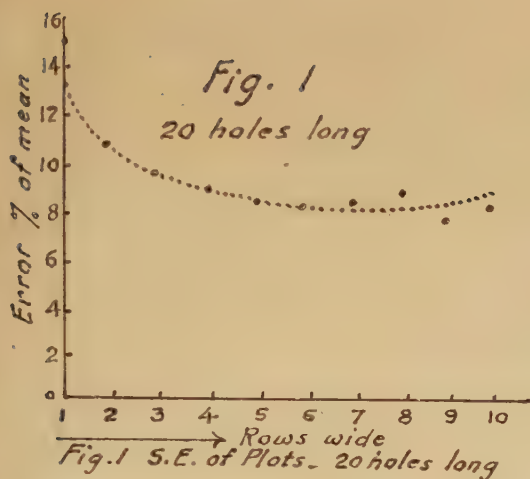
I.—Plot length, 20 holes. Fig. 1.—A rather smooth curve is obtained showing a marked drop in the standard error when the width of the plot is increased from one to two rows, with further but less marked reduction in the error as the width of the plot is increased up to 5-6 rows after which the error remains practically constant. The minimum error in the case of plots 20 holes long is thus obtained when they are 5-6 rows wide.

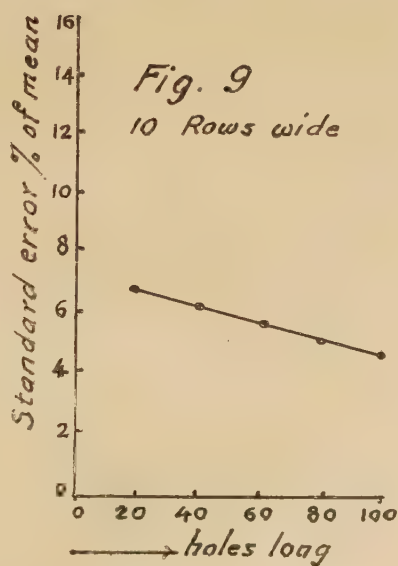
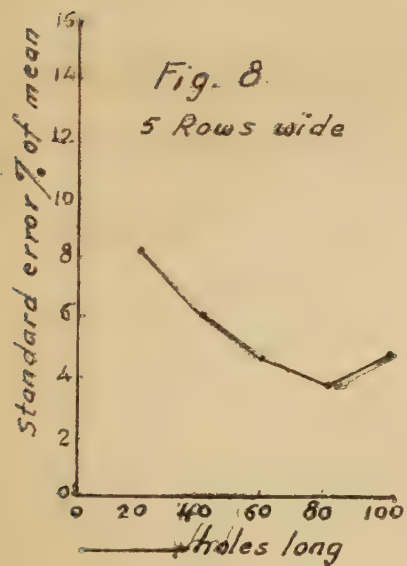
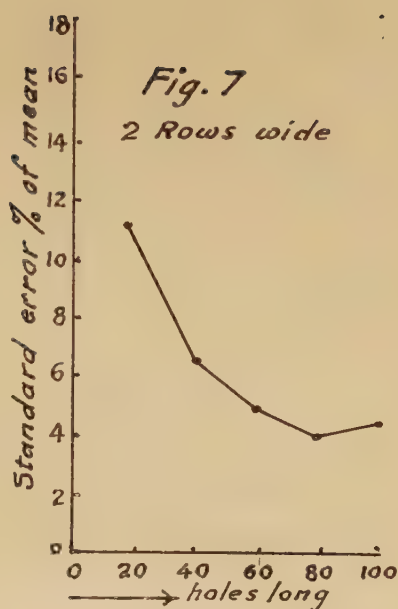
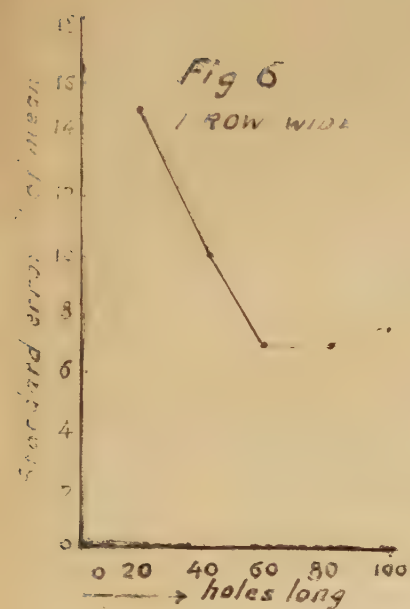
II.—Plot length, 40 holes. Fig. 2.—Here also there is a very sharp drop in the error when the width of the plot is increased from one to two rows, subsequently there is no change (apart from random fluctuations) when the plot width is increased up to 10 rows.

III.—Plot length 60 holes, 80 holes and 100 holes. Figs. 3-5.—In all these cases the standard error drops remarkably when the plot width is increased from one to two rows. The error appears to be more or less constant up to 4-5 rows, and thereafter appears to increase slightly up to 10 rows.

Random fluctuations in the error values make it difficult to observe the exact tendencies of the curves from a width of two rows upwards. It is certain, however, that in all cases where the plot length is 40 holes or over, there is not much gain in accuracy by increasing the plot width beyond two rows.

Effect of varying the length of plot.—The influence of increasing the length of plot from 20 holes to 100 holes is well brought out in Figs. 6 to 9. In all cases there is a sharp and marked decrease in the standard error when the plot length is increased from 20 holes to 40 holes: increasing the plot length further to 80 holes results in a further but smaller gain in accuracy. A further increase from 80 holes to 100 holes in most cases results in a slightly higher error in all plots up to seven rows wide. Beyond this plots of 100 holes long appear to be slightly better than plots of 80 holes.





It is here again strikingly brought out (c.f. figs 7 and 8) that for plots over 40 holes long little is gained by increasing the width beyond two rows. The minimum possible value of the standard error (viz 4.0%) was obtained with a plot length of 80 holes (200 feet) and a width of two to four rows (10 to 20 feet); such a plot has an area of $1/22$ to $1/11$ acre. In general, however, it is inadvisable to use plots as narrow as two rows wide, owing to interaction between varieties and between treatments etc., so that a plot 80 holes long by 5 or 6 rows wide, would be more convenient in practice.

Effect of shape of plot.—It is obvious from the results presented above, that, keeping the area of the plot constant, the shape of the plot markedly affects the value of the standard error. Thus a plot 20 holes long by 4 rows wide has a higher error (8.86 %) than a plot 80 holes long by one row wide (7.28 %). In fact, long narrow plots are more accurate than short wide plots. This fact has been abundantly proved by various workers on different kinds of crops.

In the present work a ratio of length to width of from 20 : 1 to 10 : 1 appears to be the most efficient.

According to the data obtained in this investigation four or five replications of plots 80 holes x 5 rows would appear to give results of extreme accuracy, and could be used to detect very small differences in responses, or in yields.

EXPERIMENTS ON THE APPLICATION OF FERTILISERS.

In the 1936 Annual Report an experiment carried out at Labourdonnais on the methods of application of fertilisers was described and it was stated (p. 41) that a similar trial would be harvested at Rose Belle S. E. in 1937. The results of this trial are now to hand.

The treatments were as follows :—

- A.—All fertilisers and scums applied at planting, farmyard manure subsequently applied when the canes were six months old.
- B.—Scums, one third Nitrogen and two thirds potash applied at planting : one-third nitrogen and remaining one-third potash applied at 4 months, spread in a zone up to 1 foot from the stools, farmyard manure applied at 6 months; at 12 months remaining one-third of nitrogen applied uniformly over interline.
- C.—The usual estate practice, viz scums only at planting, 50 kilos sulphate of ammonia applied on the stool, at 3 months, 100 kilos mixture of 7 parts sulphate of ammonia and 3 parts nitrate of potash per acre applied with farmyard manure at 6 months.
- D.—Same as B, but receiving its farmyard manure at planting.
- E.—Controls, receiving scums only at planting.

It will be seen by comparison with the Labourdonnais experiment that the treatments are largely similar, with the exception that at Rose Belle scums provide the phosphate, and that there is, in addition, an application of farmyard manure. The controls at Rose Belle also received scums, whereas no fertiliser was applied to the controls at Labourdonnais.

The total quantity of nutrients provided per acre were as follows :—
4 tons scums, 168 kgs sulphate of ammonia, 53 kgs nitrate of potash and 21 tons farmyard manure.

The mean yields in kilos per plot were as follows :—

A	B	C	D	E	Gen. Mean	Signif. Diffce.
2,342	2,366	2,280	2,236	1,152	2,075	133.0
112.9	114.0	109.8	107.7	55.0	100.0	6.4%

The four treatments A, B, C and D have given a very large increase over treatment E which received scums only. The differences between treatments A, B, C and D although just failing to reach significance are at least suggestive. Method B which gave a significantly higher yield over the other treatments at Labourdonnais has given the best yield at Rose Belle also, yielding 1.40 tons per acre more than the usual estate practice. The yields in tons per acre are as follows :—

	A	B	C	D	E
	37.5	37.9	36.5	35.8	18.4
Increase over scums only	19.1	19.5	18.1	17.4	0

The estate practice was in fact a very close approximation to the suggested method (method B) in this case, so that the small difference between the two methods might be expected.

It is proposed to repeat such experiments as much as possible, since it is only by repetition under varied conditions that small improvements in methods of application of fertilisers can be definitely established.

A continuation of the above Rose Belle experiment on first ratoons has been effected: the methods of application used are as follows :—

- A.—Holes made with crowbars around stool, and all fertilisers applied soon after harvesting plant canes, in these holes.
- B.—Holes made with crowbars as in A, all phosphate, $\frac{2}{3}$ potash and $\frac{1}{3}$ nitrogen applied in these holes soon after harvesting virgin crop. Three months afterwards remainder of potash, and $\frac{1}{3}$ nitrogen applied in a zone up to 1 foot on each side of stool. Six months afterwards remaining $\frac{1}{3}$ nitrogen applied uniformly over the interline.
- C.—Ordinary estate practice, viz a partial dose immediately after harvesting plant canes, remainder at 3 months.
- D.—Same as B, except that the first application is made in a shallow trench around stool (devidage).
- E.—Same as A, except that all fertiliser is applied in a devidage.

This experiment will be harvested in 1938.

The early fertiliser requirements of sugarcane.—It is well known that a sugarcane cutting has to survive for a limited period (i.e. until it has formed its own root-system) on minerals stored in the cutting. In most sugarcane growing countries a supply of nutrients is placed in the hole with the cuttings, thus ensuring the earliest possible *external* supply of minerals for the young plant. The question arose as to whether the earliest development of the young plant was limited to any degree by lack of minerals during this period. That this is possible is indicated by the fact that when early development (germination) is accelerated so that the roots come in contact with an external supply earlier (such as by soaking cuttings in a saturated solution of lime) an increased growth, resulting in an increased yield occurs. A new technique for the examination of fertiliser requirements during the early period was devised. This consists of removing a core from the middle internode of the cutting by means of a cork-borer, filling it up with a fertilizer mixture, sealing it with a cork stopper, and planting the cutting.

In the first experiment, it was demonstrated that ammonium salts had a marked toxic effect when thus placed within the cuttings, and in subsequent experiments, urea, (which is a readily available source of nitrogen, when applied within plants) was used. The three important elements were supplied in a mixture containing equal parts of potassium hydrogen phosphate and urea.

The first series were grown in moist sawdust from which they were able to absorb practically no food materials.

There were three boxes of treated plants each containing five cuttings and three boxes of untreated plants containing the same number of cuttings. The observations taken at the end of three months from planting are given in the following table :

			Treated	Controls
Total No. of shoots	...	...	46	38
Total length	...	...	1,001	688
Mean length	...	...	21.8	18.1
Fresh wt. of stems	...	...	402.0	253.9
Dry wt. of stems	...	...	44.3	29.9
Fresh wt. of leaves	...	...	558.5	322.5
Dry wt. of leaves	...	...	102.7	66.0
Total No. of shoot-roots	...	...	102	18
Mean No. of shoot-roots per shoot	...	...	2.22	0.47
% of shoots bearing shoot-roots	...	...	65.2	18.4

MINERAL CONTENT % DRY MATTER

Leaves

Stems

		P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N
Treated	...	0.555	2.214	1.761	0.885	3.440	1.358
Controls	...	0.325	1.825	1.459	0.325	3.180	0.872

These results show clearly (a) that the three essential elements placed in the cutting in this manner are capable of being mobilised by the plant, (b) that they result in better growth of the young shoots and roots. A small experiment carried out in the field at Réduit to determine the effect of the treatment on the rate of germination of the cuttings indicated a marked acceleration and percentage survival as a result of the treatment.

A fairly extensive field trial has been laid down at Pamplémousses Experiment Station in which three treatments are included viz (A) Mixture placed within cutting as described above, (B) Equal quantity of mixture placed outside cuttings in the hole, (C) Controls with no mixture. At the time of writing the plants in treatment A were definitely in advance of those in treatments B and C. This subject is still in the academic stage and it is not known at present whether any practical recommendations will result.

MISCELLANEOUS INVESTIGATIONS.

I. Pot experiments on time of application of nitrogen, potash and phosphate.—The pot experiments on this subject referred to in the Annual report for 1936 had to be abandoned when the plants were six months old, owing to the unsatisfactory growth and appearance of the plants, the cause of which was difficult to establish. A few interesting points came out from the early growth of the plants, however, e.g. the marked importance of an early supply of phosphate, tillering particularly being much more vigorous in those supplied with phosphate at planting, and the marked effect of a dose of nitrogen before the advent of the cold season, those plants which had been supplied with nitrogen at, or before the beginning of the cold season, were much greener in colour and more healthy looking than those from which nitrogen had been withheld during this period. A repetition of the whole experiment is being attempted.

2. *Phytalus Resistance Trial*.—The great difficulty in correlating root-characters with *Phytalus* resistance has, hitherto, been the lack of reliable information on the *Phytalus* resistance of different varieties. The only varieties on which planters are more or less agreed as to their having some resistance are M. 108/30, M. 27/16 and Uba. The varieties BH. 10 (12) and White Tanna, on the other hand, are conceded to have little or no resistance. Beyond this there is little or no reliable information. A large scale *Phytalus* Resistance Trial was, therefore, laid down at Côte d'Or S.E. on land which was, previous to the experiment, very badly infested. The following eight varieties were included: M. 72/31, POJ. 2878, POJ. 2727, SC. 12/4, Selangor Seedling, M. 108/30, M. 73/31 and BH. 10 (12). It is hoped that some definite information on the *Phytalus* resistance of these varieties will be obtained, though the subject is complicated and there is no guarantee that the *Phytalus* will still be located in this field. The object of the experiment, apart from obtaining information on the resistance of these varieties is to obtain information as to what constitutes resistance. The root behaviour of most of these varieties is now well known; it will, therefore, be of interest to determine what root features, if any, constitute resistance. It is becoming apparent, that, although root-habits may be important there are other obscure factors such as power of recovery after attack, time of tillering and perhaps the degree to which the roots appeal to the taste of the larvae which may play a considerable part in *Phytalus* resistance.

3. *Vernalization Trial*.—The canes which had been vernalized (see Annual Report 1936) failed to flower in the 1937 arrowing season, and the vernalization treatment used may thus be considered to have failed as an inducement to arrowing in those varieties that do not normally flower in Mauritius e.g. BH. 10 (12). It has, however, been left standing until 1938, in case any flowering occurs. Not much hope is entertained, however, as plantings of BH. 10 (12) and White Tanna left standing for three years have not once flowered. No further work is, therefore, contemplated on this problem at present.

A few experiments on the preservation of cut canes in preservative solutions were carried out during the 1937 flowering season—partial success was obtained, a thousand or so seedlings were obtained in the green house from crosses effected in preservative solutions. This work has been fully described in a paper forwarded to the *Revue Agricole* for publication.

Two bulletins (Bulletins 12 and 14), some papers in the *Empire Journal of Experimental Agriculture* and in the *Revue Agricole* were published during the year, and one paper prepared for the *Annals of Botany*.

January, 1938.

H. EVANS,
Botanist.

APPENDIX—LIST OF PUBLICATIONS OF THE SUGARCANE RESEARCH STATION, DEPARTMENT OF AGRICULTURE.

I.—REPORTS

- Report on a Visit to the Proefstation-Oost-Java in March-April. 1930; by A. Glendon Hill (out of print).
 First Annual Report, 1930 (out of print).
 Second Annual Report, 1931.
 Third Annual Report, 1932.
 Fourth Annual Report, 1933—(out of print).
 Fifth Annual Report, 1934.
 Sixth Annual Report, 1935.
 Seventh Annual Report, 1936.

II.—BULLETINS

Bulletin No. 1 :

- (a) Results of Manurial Experiments harvested in 1931 and 1932;
 (b) Results of Variety Trials harvested in 1931 and 1932; by N. Craig, M.Sc. ... (1933)

Bulletin No. 2 :

- Preliminary Investigations of the Growth Rate of the Sugarcane; by A. Glendon Hill, B.A., B. Agr., A.R.C. Sc. I., and H. Evans, Ph. D. (out of print) ... (1933)

Bulletin No. 3 :

- Some Preliminary data concerning the best Shape and Size of Plot for Field Experiments with Sugarcane; by H. Evans, Ph. D. (out of print) ... (1934)

Bulletin No. 4 :

- Some Properties of the Sugarcane Soils of Mauritius; by N. Craig, M.Sc. (English and French editions) ... (1934)

Bulletin No. 5 :

- Studies on Root-Exudation and Root-Type in Sugarcane by H. Evans, Ph. D. (out of print) ... (1934)

Bulletin No. 6 :

- Investigations on the Root-System of Sugarcane Varieties; by H. Evans, Ph. D. (out of print) ... (1935)

Bulletin No. 7 :

- Investigations on the Course of Growth in a Virgin or Plant Crop of Sugarcane; by H. Evans, Ph. D. ... (1935)

Bulletin No. 8 :

The Maintenance of First-Year Characters in New Sugarcane Clones : by A. Glendon Hill, B.A., B. Agr., A.R.C.Sc.I. (1935)

Bulletin No. 9 :

Base Exchange Relationships in Mauritius Soils ; by N. Craig, M.Sc.... .. (1935)

Bulletin No. 10 :

Some Data on the Effect of a late heavy Dressing of nitrogenous Fertiliser on the Growth and Metabolism of Sugarcane in Mauritius ; by H. Evans, Ph. D. (English and French editions) (1936)

Bulletin No. 11 :

Sugarcane in Mauritius : A Revue of the present Position with Respect to its Cultivation and Manuring ; by N. Craig, M.Sc. (English and French editions) .. (1937)

Bulletin No. 12 :

Further Investigations on the Rcot-System of Sugarcane ; by H. Evans, Ph. D. (English and French editions) . (1937)

Bulletin No. 13 :

An annotated Catalogue of Sugarcane Varieties in Mauritius ; by A. Glendon Hill, B.A., B. Agr., A.R.C.Sc.I. (1937)

Bulletin No. 14 :

A preliminary Study of Root Characters as affecting Drought Resistance in two Sugarcane Varieties and in their Seedlings ; by H. Evans, Ph. D. ... (1937)

For publications of the Department of Agriculture, other than those of the Sugarcane Research Station, application should be made to the Director of Agriculture, Réduit.

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